

# The Multibus<sup>\*</sup> Buyers Guide

Q quantum electronics  
Box 391262  
Bremley  
2018

**SPECIAL!**  
Introduction to the  
**Multibus<sup>\*</sup> II**

*"... we make the vital connection"*

A directory of  
Multibus compatible  
micro computer  
products

- Single Board Computers
- Dynamic RAM
- Static RAM
- RAM/ROM
- CRT Controllers
- Analog Input/output
- Serial I/O Expansion
- Peripheral Controllers

Model Numbers •  
Prices • Specifications •  
Special Features

Current, Complete  
Vendor Data  
Sales Office  
Locations  
New Products



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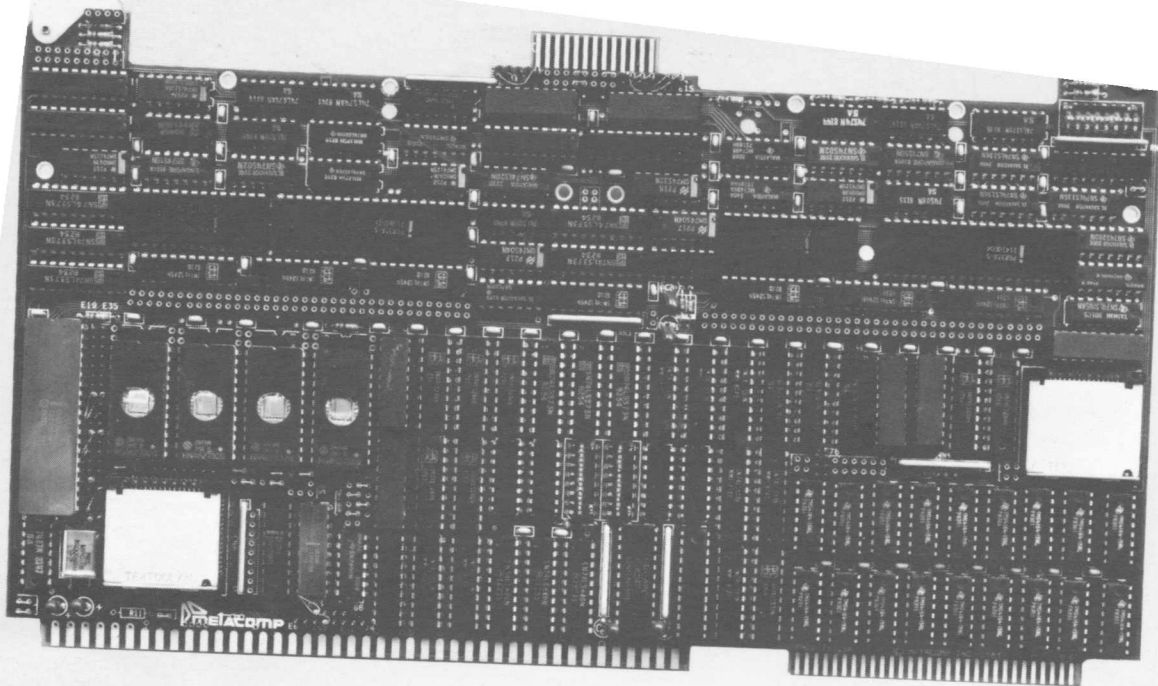
3239 Caminito Ameca  
La Jolla, CA 92037  
(619) 450-0191

The product locator  
service for Multibus  
microcomputer  
systems

\$35<sup>00</sup> per copy

**Winter '84**

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of INTEL CORPORATION

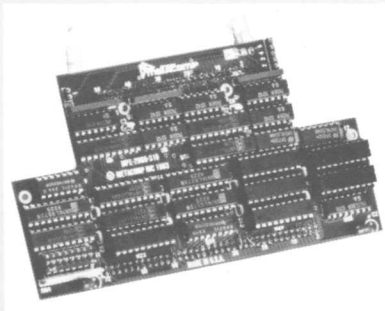


# PERFORMANCE + FROM THE MPA-2000 CPU/INTELLIGENT I/O CONTROLLER

**MULTIBUS\* MODULARITY GIVES YOU UNPARALLELED FLEXIBILITY**

Metacomp's MPA-2000 CPU/Intelligent I/O Controller provides unequalled performance and modularity for Multibus applications. Features and support for the MPA-2000 include.

- Standard Multibus interface.
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  - 64K EPROM
  - 128K RAM with parity (64K can be dual-ported)
  - i80130 (iRMX-86\* kernel) or i80150 (CP/M-86)



- Eight programmable DMA channels
- Low profile plug-in modules
  - Field interchangeable

- Modules for serial I/O, disk, parallel I/O and LAN
- Served by DMA channels
- Configurable as iSBX\* module sites

## Application possibilities include

- Serial I/O supporting ASYNC, BISYNC, BITSYNC and DLC's such as: SDLC, HDLC, X.25 and SN
- SCSI interface for disk, tape, floppy or parallel I/O.
- Local Area Network, including Token Ring and Ethernet.
- Single board computer.

Put Metacomp's Performance + MPA-2000 to for you. For additional details and application or write us today.



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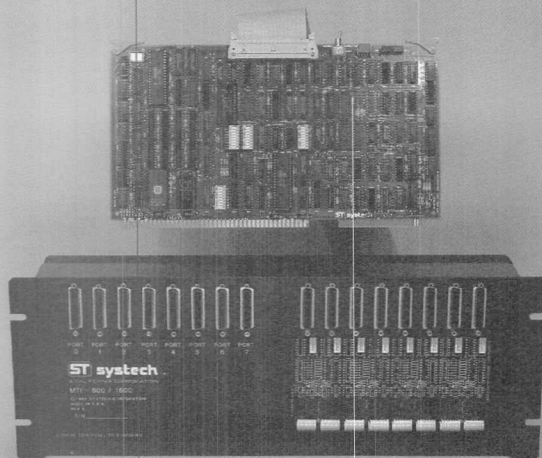
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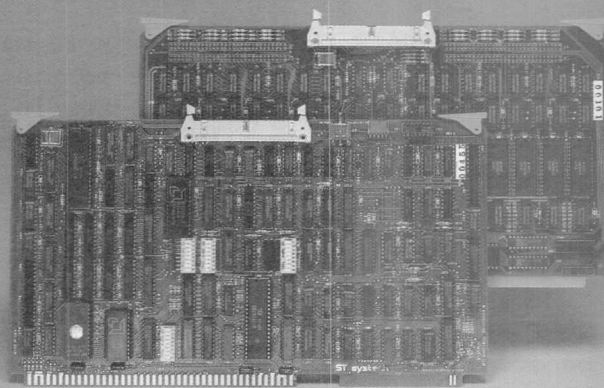


# RESPONSIBLE MULTIBUS<sup>\*</sup> SUPPORT

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MTI 800A/1600A



MTI 800B/1600B

## DMA Communications Controllers

- + UNIX<sup>\*</sup> DEVICE DRIVERS to licensed users
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<sup>\*</sup>Multibus is a trademark of Intel Corp.

<sup>\*</sup>Unix is a trademark of Bell Labs.

# The Multibus<sup>®</sup> Buyers Guide

---

The Multibus interface, developed by Intel in 1977, was the first multi-processing bus architecture to have its physical and electrical specifications released to the public. Because the Multibus architecture provided well-documented specifications along with versatility and ease of use, the electronics industry quickly accepted the Multibus architecture as a de facto industry standard. In fact, the Multibus architecture has become so well-accepted that over 200 manufacturers now produce Multibus-compatible boards and backplanes.

The IEEE P796 Working Group was formed in 1978 and submitted a draft to the IEEE Computer Standards Committee in December 1980 to formally standardize the Multibus architecture. At the December 1982 meeting of the IEEE Standards Board the IEEE P796 became an official standard.

Copies of the IEEE 796 Standard may be ordered from:

IEEE Service Center, CP Dept.  
445 Hoes Lane  
Piscataway, NJ 08854



The Multibus\* Buyers Guide is a semi-annual publication listing all the Multibus\* compatible products currently available. The main purpose is to provide system designers, O.E.M. integrators and manufacturers a time saving method of surveying an entire market that is rapidly changing.

Our first priority is to list all the products and who manufactures them. The second priority is to seek out and consolidate important specifications and present them in a summerized easy-to-read format. To do this we are directly in contact with over 200 Multibus manufacturers on a daily basis.

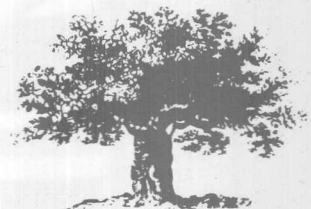
".....we make the vital connection"

We have knowledge of manufacturers not listed in this guide. I feel that if a manufacturer is non-responsive to several direct inquiries about his product he may not be a valid source for buyers.

It is our hope that The Multibus Buyers Guide helps you keep abreast of the rapidly expanding world of Multibus compatible products.

Sincerely,

*Fred Mazanec*  
FRED MAZANEC  
Publisher



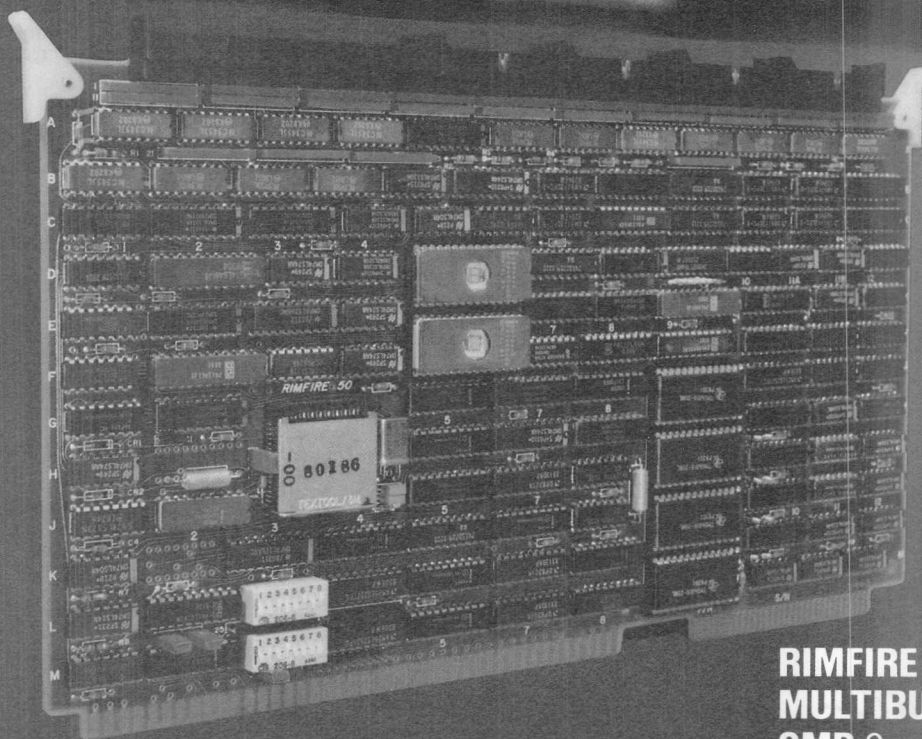
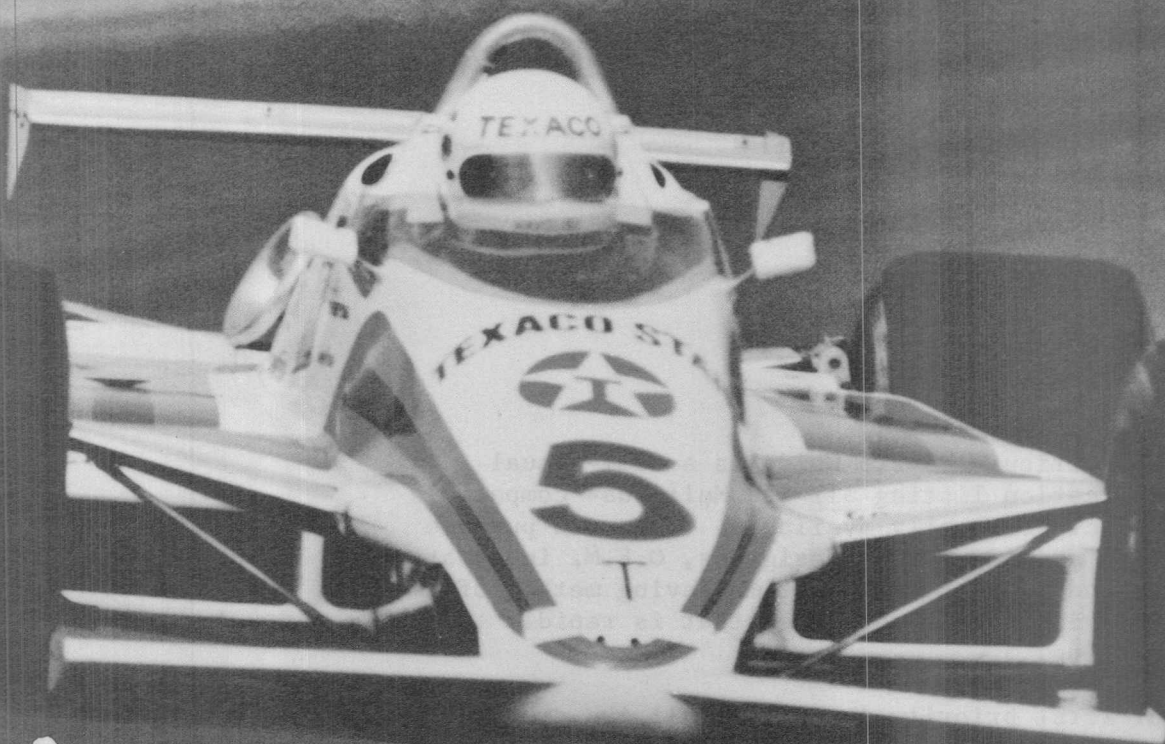
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# MORE HIGH PERFORMANCE FROM CIPRICO™ **RIMFIRE™ 50 SMD DISK CONTROLLER**



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**RIMFIRE 50, Intelligent  
MULTIBUS\* CONTROLLER for  
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- Programmable sector sizes
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- ... and much, much more!

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# The Multibus<sup>®</sup> Buyers Guide

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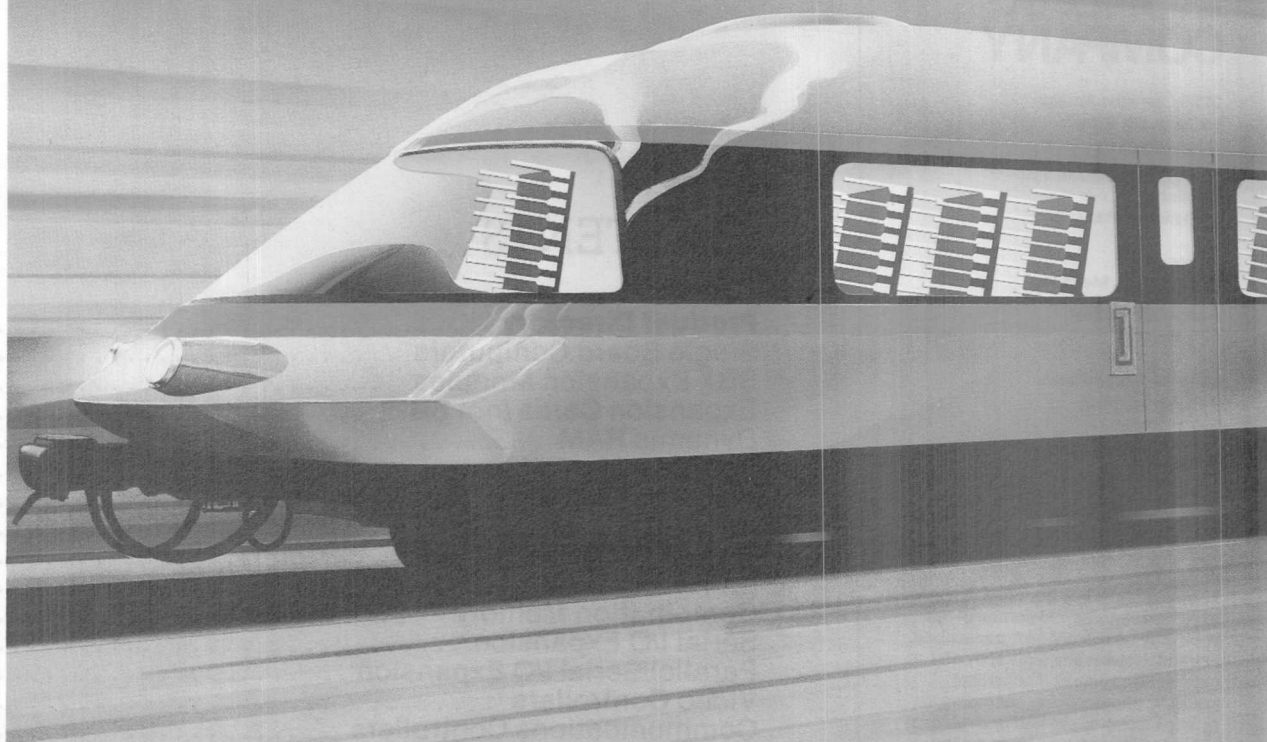
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# 1 MBYTE RAM Now On Board Here!



## ADVANCED MICRO DEVICES from HAMILTON/AVNET

The megabyte RAM board is here: Advanced Micro Devices' Multibus\*-compatible Am97/1024B, with 1024K dynamic RAM on a single board.

**Multi-MB systems: now reality.** Start thinking in terms of megabytes instead of kilobytes as you design-in RAM boards. The Am97/1024B makes it not only possible, but practical, for systems requiring large RAM space.

**Full 24-bit addressing, 16 MB range.** Add boards for increased capacity anywhere in the memory space, to keep up with your expanding system.

**Only 12.5 watts per MB (max.).** Power dissipation this low (half that of many other memory boards) keeps power supply and cooling requirements to a minimum. Use these savings along with your space savings to offer a more powerful system at a lower cost!

**Speedy 200ns access.** Access time this fast improves performance throughout your system.

### Byte-wide parity error detection.

Parity logic enables detection of single bit errors and allows corrective action. So along with high density, you get a means to ensure accuracy.

**Very affordable \$2995.** Compare the price you'd pay for the number of kilobyte RAM boards required to reach Mbyte capacity. You'll find the Am97/1024B's price of \$2995 very competitive. Plus you get the design advantages of all that capacity on one board.

**Fast delivery, with application support.** Our fast service includes not only product delivery, but product application assistance. Our factory-trained computer product specialists team up with Advanced Micro Device's application engineers to help you increase engineering productivity and ensure the best price/performance ratio for your system. Call us now—and see why we're the #1 source for all your Advanced Micro Devices system needs.

**Hamilton Avnet**  
ELECTRONICS  AN AVNET COMPANY

A commitment to stock and serve your local market!

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# The Multibus<sup>®</sup> Buyers Guide

## Product Directory . . .

The purpose of the PRODUCT DIRECTORY is to categorically list all compatible board-level and system products by manufacturer and model number. The listed price is quantity one, end-user, and subject to change without notice. The date first available (DFA) is shown where possible, to indicate relative newness of a product. Delivery times are also subject to change without notice.

We urge you to contact the manufacturer directly or their local sales office regarding any products of interest. To facilitate this, we have included the manufacturers phone number next to each product listing and a MANUFACTURERS SALES OFFICE DIRECTORY.

### Legend

- ★ New Product- introduced within the last six months.
- Not specified in literature or not available or unclear at this writing.
- Optional
- o Parameter is included.

NA Not Available

DFA Date First Available.

Deliv. Approximate delivery ARO.

**MICROBAR SYSTEMS, INC.**



# Who gets blamed when your applications grow and your single board computer doesn't?

Choosing a Single Board Computer (SBC) isn't easy. First, you've got to make sure that the SBC you choose is right for the job you're doing now. With enough speed, memory and flexibility to do what you want.

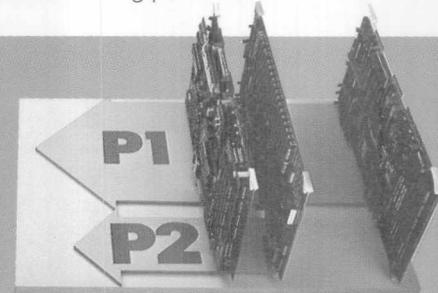
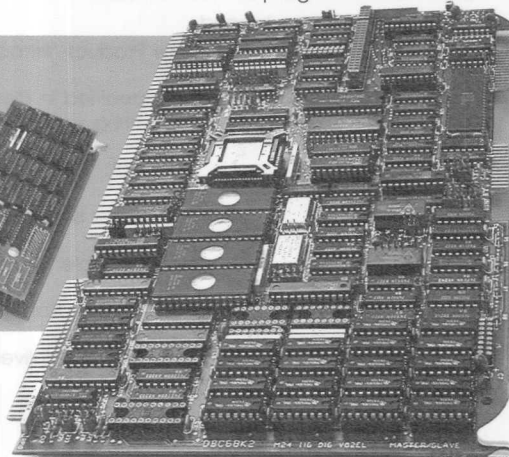
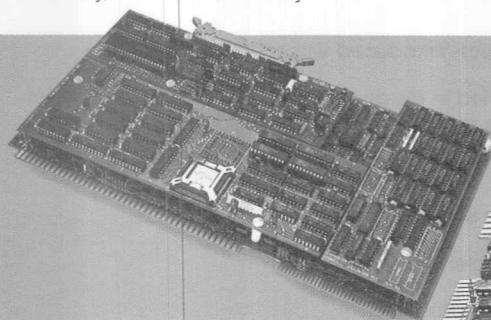
Next, you've got to make sure that you look far enough ahead, because what may have seemed like a simple enough application at the start can grow very quickly. Suddenly, you need more speed, more memory, and more flexibility.

Multimodule interface, capacity for 128K bytes of PROM, and Microbar's unique Dual Bus™ architecture. That's the basic DBC68K2, the K2.

You'll also get—standard with the K2—features such as programmable baud

munication between the CPU and all that off-board memory on the P2 connector. With data transfer between memory and other processors handled on the P1 path.

Which means you can "add off"—add more memory boards that back up the K2's on-board memory. Or add other SBCs, with their own processors and memory, for very high-powered computing applications that demand multi-user, multi-tasking performance.



Finally, the single board computer you've chosen for one function may be called on later to handle completely different tasks as well—not just word processing, for instance, but graphics computation, communications, process control or data base management.

In other words, the computer that's at the heart of your system must be the right choice for now, the right choice as your applications grow, and the right choice as your applications change.



**Begin with high performance**

You won't go wrong starting with the powerful Motorola MC68000 microprocessor, in 10 or 12 MHz versions, 128K bytes of dual-ported on-board memory, the iSBX™

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Dual Bus is a trademark of Microbar Systems, Inc.  
XENIX is a trademark of Microsoft Corporation

rates, two 16-bit timers, two RS232C serial ports with asynchronous and synchronous protocols, and dynamically-selectable byte-swapping and word reversing.

## **The K2: The SBC with Add-Ons**

Then add on RAM modules that boost on-board memory to 256Kb or 512Kb, the SBX-compatible parallel I/O module from Microbar, or any of the wide variety of available SBX modules. And, you can add on your choice of memory management options—either a segment-oriented (68451) or 2-level page-oriented MMU. That means you can support high performance operating system software such as XENIX.™

## **The K2: The SBC that also "Adds Off"**

Because of Microbar's clever use of the IEEE 796 bus architecture, you also get the advantages of direct high speed com-

## **The K2: Versatility that protects your decision**

So if you've got the responsibility for choosing an SBC that's right for today's and tomorrow's systems, choose Microbar's DBC68K2. With its add-on and add-off flexibility, and its performance versatility, you'll know the K2's the board that will grow as your applications grow. Call or write **Microbar Systems, Inc.** 1120 San Antonio Rd., Palo Alto, CA 94303, 415/964-2862, Twx: 910 373 2047

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SYSTEMS, INC.**



# Single Board Computers

## AMD

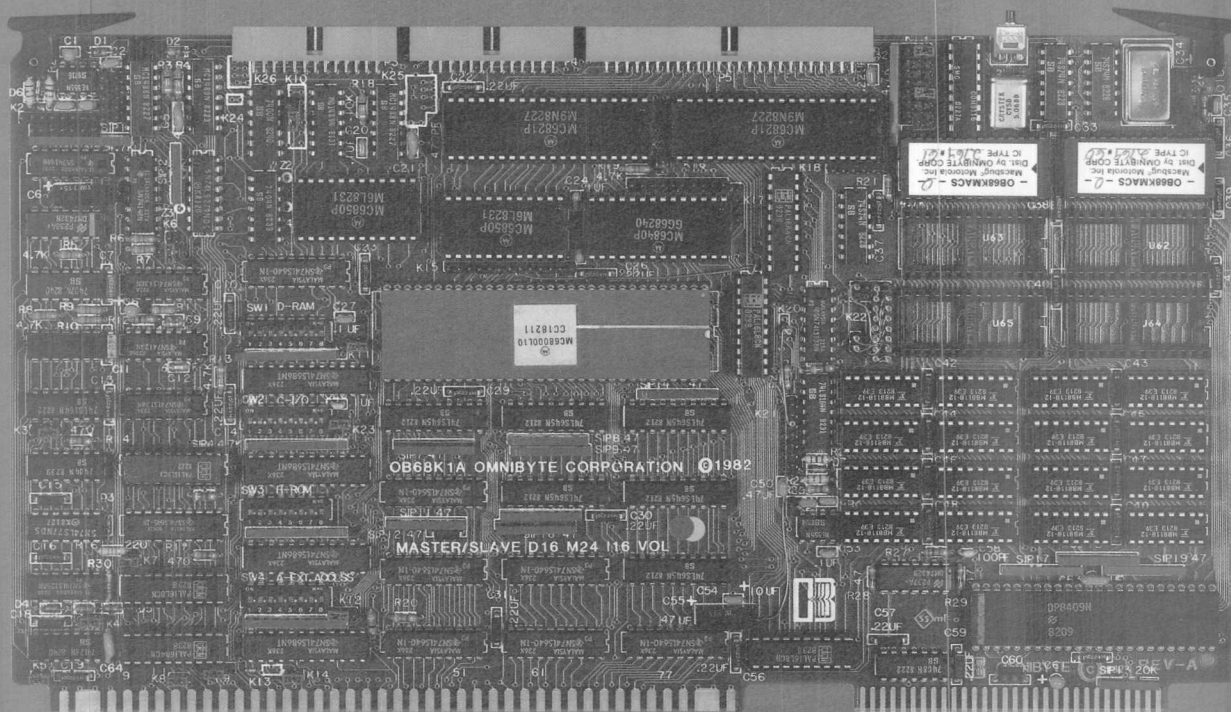
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Bridge Communications, Inc.  
Bubbl-Tec  
Central Data Corp.  
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Relms  
SBE, Inc.  
SGS Semiconductor Corp.  
Single Board Solutions  
Systemathica  
TITN, Inc.  
TSD Display  
Zendex Corporation

# OMNIBYTE

## OB68K1A®



### MC68000 / IEEE-796 (MULTIBUS)\* SINGLE BOARD COMPUTER

#### THE BEST JUST GOT BETTER

The OB68K1A is an extremely powerful stand-alone microcomputer board designed to serve as a high performance upgrade for OMNIBYTE's popular OB68K1 single board computer. It features:

- ★ 10MHz MC68000 16/32 BIT CPU
- ★ 32K / 128K / 512K-bytes of dual ported RAM
- ★ Zero wait state RAM access
- ★ Up to 192K-bytes of EPROM
- ★ (2) RS232C serial ports
- ★ (2) 16-BIT parallel ports
- ★ A triple 16-BIT timer / counter
- ★ (7) prioritized-vectored interrupts
- ★ Switch selectable memory mapping

- ★ Software / hardware selectable baud rate generator
- ★ Directly addresses 16M-bytes
- ★ IEEE-796 (MULTIBUS)\* compatible
- ★ A (2) year limited warranty

The OB68K1A is a high performance single board computer designed as a direct replacement for our OB68K1. Enhancements include a 10MHz MC68000 CPU, hardware ram refresh circuit with zero-wait-state operation, 32K or 128K-bytes of ram (512K-bytes in fourth qtr., 83), up to 192K-bytes of EPROM, and a low noise multi-layered design. Other features include (2) RS232C serial ports, crystal controlled baud rate generator (50-19.2K), (2) 16-bit parallel ports, a triple 16-bit timer/counter, and 24 address lines for directly addressing up to 16M-bytes.

#### SOFTWARE SUPPORT

A variety of software packages are available for the OB68K1A. They range from the optional MACSBUG monitor/ debugger to Realtime Executives and Target Operating Systems in silicon. Four commercial software manufacturers have complete operating systems, including development tools and high level languages.

*FOR MORE INFORMATION ABOUT THE OB68K1A, ASK FOR OUR FREE SUMMARY SHEET OR SEND \$10 FOR A DETAILED TECHNICAL MANUAL.*

Contact Sue Cochran, Sales Manager

**Quality, Reliability,  
Performance**

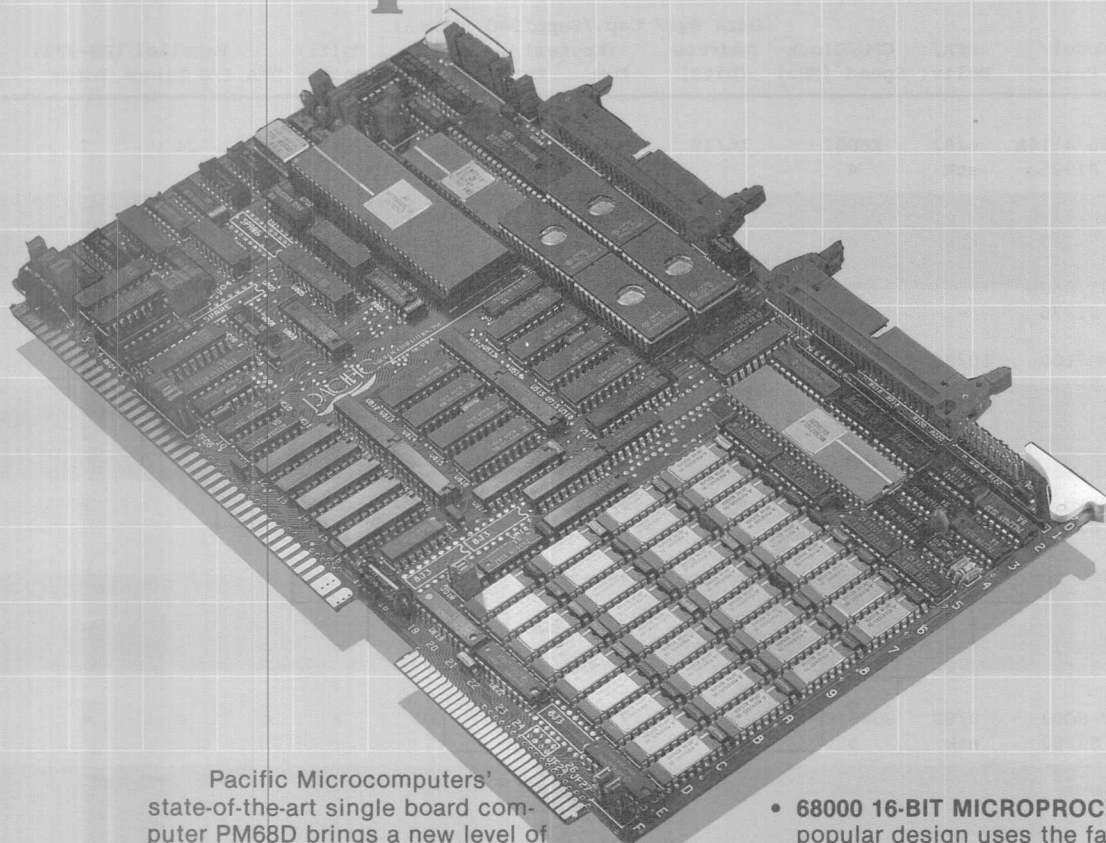


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#### OMNIBYTE CORPORATION

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Pacific Microcomputers' state-of-the-art single board computer PM68D brings a new level of price performance to the single board computer. It combines the most powerful 16 bit microprocessor, the 68000, with RAM, PROM, memory management and input/output capabilities to provide **RELIABLE, HIGH-SPEED PROCESSING AT LOW COST.**

- **DUAL PORTED MEMORY** allows direct memory access - eliminating the need for slow Multi-bus Memory, improving system performance and **LOWERING OVERALL SYSTEM COST.**
- **DUAL PORTED EXPANSION MEMORY** provides **NO-WAIT STATE MEMORY** expansion - up to 8 Mbytes for large system requirements.
- **NO-WAIT STATE MEMORY** provides the fastest processing capability on the market.
- **TRUE PARALLEL INPUT/OUTPUT** allows interfacing directly from the CPU board to external devices such as Centronix printers, SASI bus controllers, QIC II 1/4" cartridge tapes or other custom interfaces.
- **16 MBYTE VIRTUAL ADDRESS SPACE** supports today's larger programming needs.
- **MAILBOX INTERRUPTS**, in addition to standard interrupts for both on-board and Multibus devices, permit more efficient control in multiprocessor applications.

- **68000 16-BIT MICROPROCESSOR** - This popular design uses the fastest chip available. Non-segmented address space makes programming easy. Memory management designed to allow faster context switching between 16 simultaneous processes.
- **UNIX™ SOFTWARE AVAILABLE** to support larger programming requirements - includes compilers, word processors, spread sheet calculators and data base managers. This **INDUSTRY STANDARD OPERATING SYSTEM** supports a wide variety of languages and has many tools available.

The result? Significantly faster processing by eliminating wait states, and providing more efficient peripheral I/O and multiprocessor operations. All at less expense through direct memory access and parallel input/output.

**Pacific Microcomputers' PM68D.** State-of-the-art performance. State-of-the-art price.

For more information call 619-436-8649.



**MICROCOMPUTERS, INC.**

119 Aberdeen Drive  
Cardiff, CA 92007



# Single Board Computers

Manufacturer	Model/ Price	DFA/ Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	DMA	Parallel (RS-232) I/O Lines	Ports
AMD .....	96/4116A \$1995	6/82 stk	Z8002 4	16/19	8/- 32/32	512K	o	-	24	2
	96/4126 \$2245	stk	Z8002 4	16/19	8/- 128/128	512K	o	-	24	2
	97/8605 \$1775	-	8086 -		64/- 8/8	-	-	-	24	1 2*
Advant Corp. ....	MS7100 \$-	10/82 -	68000 8	16/24	16/16 2/2	16M	o	o	-	2
AIM Technology .....	68000CPU \$2500	5/82	68000 8	16/24	16/16 2/2	16M	o	o	-	2
Bridge Communications, Inc..	MCPU \$2500	12/82 6wk	68000 10	16/24	32/- 384/256	16M	o	o	o	2
Bubbl-Tec .....	BBC-128 \$1795	11/82	Z80A 4	-/-	64/- 64/-	-	-	-	16	2
Central Data Corp. ....	B1017 \$710	6/80 stk	Z8001 4	16/24	4/- 0/0	16M	o	o	o	-
Century Computer Corp. ....	V-8003 \$2200	9/82 stk	8088/85 5	8/20	16/- 128/128	1M	-	o	o	4
Christian Rovsing Corp. ....	MPMP \$-	-	8088 -	8/20	64/- 128/-	-	-	-	o	2
Codata Systems Corp. ....	68000CPU \$2450	4/81 -	68000 8	16/24	32/2 256/256	256K	o	o	16	2
Comark Corporation .....	MC85 \$895	1/80	8085 5	8/16	16/- 6/6	64K	o	-	48	1
	MC86 \$2995	12/82	8086 10	16/24	64/32 128/128	16M	o	-	24	1
Cosmos Systems, Inc. ....	CMT-CPU \$2850	3/82 -	68000 8	16/24	16/- 64/64	16M	o	o	16	2
	CMT-SBC \$-	-	68000 10	16/24	32/- 256/-	16M	o	o	16	2



# Single Board Computers

Counter Timers (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
5/16	10/23	-	-	4.0 MHz AmZ8002 CPU with 32 Kbytes of dual ported RAM, two Am9551 serial ports, one Am8255A parallel I/O chip, an Am9513 timer, and an 8259A interrupt controller.
5/16	10/23	-	-	5-bit memory page register, two 24/28 EPROM sockets.
-/-	-/-	-	3	On-board 8087 math co-processor, 4 PROM sockets.
3/16	7/19	o	-	Optional FP processor. On-board MMU easily accomodates multi-tasking operating system. On-board diagnostics and maintenance port do not require bus for operation.
3/16	7/19	o	-	Not SBC but SuperMicro Computer element with Mini computer architecture. Optimized "OS" derived from Bell Laboratories UNIX System 3. Advanced MMU and scattered page loading. On-board diagnostics and maintenance port accessible.
5/16	8/1	-	1	68000 based, 10 MHz, no-wait states, very high performance and large RAM area.
4/-	-/-	-	-	Complete general-purpose microcomputer with on-board magnetic-bubble memory for non-volatile storage of programs and data. Runs CP/M or other operating system from on-board bubble. Z-80A processor.
3/16	10/13	o	-	Memory divided into 2K pages mapped onto addresses by the on-board circuitry. Optional Am9511 APU.
3/16	0/0	-	o	Boot-strap EPROM of 2 to 16KB. Real-time clock with battery back-up. 3iSBX connectors. Addition connectors for piggyback memory.
-/-	-/-	-	3	Optional 8087 math co-processor, on-board floppy disk interfaces for up to 4 floppies.
-/-	7/-	o	-	
3/16	12/-	-	-	
3/16	12/-	-	2	MS-DOS or CP/M86 in PROM included. Paging register supports 16MB RAM. DISKRAM software available for 8MB of superfast "silicon disk." 9211A math option. Centronics Port standard.
0/0	7/-	-	-	
3/16	7/-	-	1	

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# Single Board Computers

Manufacturer	Model/ Price	DFA/ Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	DMA	Parallel (RS-232) I/O Lines	Ports
Cyb Systems, Inc. (512)458-3224	CPU 68000 \$2990	9/82	68000 8	-/-	-/-	-	o	-	-	2
Densan Co., Ltd.	DSB-86/12A \$-	-	8086 5	16/-	32/- 128/32	-	-	-	24	1
Distributed Computer (617)890-8200	DCS 8010A \$500	- -	8080 2	8/16	32/- 4/4	64K	o	o	48	2
	DCS 86/16 \$1200	- -	8086 -	16/20	24/- 12/2	1M	o	o	24	3
Diversified Technology (601)856-4121	CBC800/216 \$994	8/80 -	NSC 800 2.5	8/16	32/- 16/16	64K	o	-	44	1
	CBC80C/24-08 \$945	1/83	NSC 800 3.58	8/16	24/- 16/8	64K	o	-	48	1
	CBC86C/05 \$1395	*1/84	80C86 5	16/20	128/0 16/16	1M	o	-	24	1
Edge Micro Systems	B86-CPU-X \$790	-/82	8086 5	16/20	8/-	-	-	-	o	3
Eirich Machines, Inc.	EMCON 601 \$1280	7/82	8085A 3	8/16	64/- 64/-	64K	-	-	24	2
EMM/Sesco	SECS 86/05 \$6950	- -	8086 5	-/-	64/- 64/8	1M	o	-	24	1
	SECS 88/25 \$8950	- -	8088 5	-/-	64/- 64/8	1M	o	-	24	1
	SECS 80/10A \$2850	- -	8080A 2	-/-	8/- 1/1	65K	-	-	48	1
ETI Micro (415)829-6600	8108 \$965	11/81 -	8085/88 3 or 5	8/16 8/20*	6/6 1/1	64K 1M*	o	-	12	2
Fairchild/Schlumberger (408)773-2101	F68-PEP \$890	- stk	6802/6808 1 or 2	8/*	32/0 8/8	65K	o	-	16	2
	PEP-45 \$1765	6/82 6mo	F9445 16,20 or 24	16/16	32/4 8/8	65K	-	-	16	2
Forward Technology, Inc.	FT-68M \$2621	81 -	68000 8	16/24	32/- 256/256	1.5M	o	-	16	2
	FT-68X \$3145	82 30da	68000 10	16/24	32/- 256/256	8.25M	o	o	16	2
Frontier Technologies Corp. (414)964-8689	CPC-M \$1995	*2/84 -	-	-	-	-	-	-	-	-

# Single Board Computers

Counter Timers (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
-/-	-/-	-	-	Has Motorola's 8MHz MC68000, up to 512Kbytes of on-board memory (with no-wait states); two 800K baud serial ports, and segmentation over paging memory management.
3/-	8/-	-	-	Two boards, dual-port.
0/0	1/-	-	-	Two serial ports, industrial 550 burn-in; superset Intel 8010A.
3/16	9/12	-	-	Real-time clock, HDLC/SDLC capability, RS-422, 55°C "burn-in."
3/16	12/20	-	-	Complete CMOS design; under 1W of power dissipation.
3/16	12/-	-	2	CMOS design, under 1W of total power dissipation allow power alternative to the iSBC/24. On-board battery provides non-volatile memory.
3/16	9/24	-	2	CMOS design. Allow power alternative to the iSBC 80/24. On-board battery provides non-volatile memory.
3/16	7/-	N/A	-	2 parallel I/O ports, includes DMA floppy controller.
6/16	8/-	N/A	2	Can access up to 64K of off-board memory.
-/-	9/16	-	-	MIL-Spec.
-/-	9/16	-	-	Two board set, ruggedized.
-/-	1/6	-	-	
3/16	8/15	-	-	Co-resident 8085A & 8088 CPU's with boot and monitor for each, battery back-up for calendar clock, hardware math, busmaster capability, 2 priority interrupt controllers.
3/16	1/4	o	-	On-board EPROM programmer.
1/-	5/-	o	-	On-board EPROM programmer.
5/16	7/21	o	-	Offers memory management.
5/16	7/-	o	o	Supports expansion to 1Mbyte of no-wait state, local memory on a private bus.
-/-	-/-	-	-	Same architecture as the IBM PC. Allows IBM software to run in a Multibus environment.

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# Single Board Computers

Manufacturer	Model/ Price	DFA/ Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	DMA	Parallel I/O Lines	(RS-232) Ports
Heurikon Corporation ..... (608) 271-8700 (800) 356-9602	MLZ-90A \$1195	7/80 stk	Z80A 4	8/20	72/- 16/16	1M	o	o	322	2
	MLZ-91A \$1895	5/81 stk	Z80A 4	8/20	16/- 64/64	1M	o	o	8*	2
	MLZ-92A \$1895	11/81 30da	Z80A 4	8/20	16/- 64/64	1M	o	o	8*	4
	MLZ-93A \$2195	1/82 30da	Z80A 2 or 4	8/16	32/- 128/128	16M	o	o	16	3
	HK-68A \$3295	9/82	68000 8	16/24	64/- 256/256	16M	o	o	16*	2
Intel Corporation ..... See Sales Office Listing	iSBC 186/03 \$-	-	80186 6	16/24	384/6 64/0	16M	o	o	24	2
	iSBC 86/30 \$2990	-	8086-2 5 or 8	16/20	64/0 256/128	1M	o	o	24	1
	iSBC 286/10	*	80286 8	16/24	256/0 80/0	16M	o	o	12	2
	iSBC 86/14 \$2290	-	8086-2 5 or 8	16/20	64/0 64/32	1M	o	o	24	1
	iSBC 86/12A \$1900	-	8086 5	16/20	32/0 64/32	1M	o	o	24	1
	iSBC 86/05 \$1645	-	8086-2 5 or 8	16/20	128/0 16/8	1M	o	o	24	1
	iSBC 88/40 \$2000	-	8088 5	8/20	128/0 8/4	1M	o	-	24	iSBX 351
	iSBC 88/25 \$790	-	8088 5	8/20	128/0 16/4	1M	o	o	24	1
	iSBC 80/30 \$1565	-	8085A 2.76	8/16	8/0 16/16	64K	o	o	24 24*	1 2*
	iSBC 80/24 \$945	-	8085A-2 4.84/2.42	8/16	32/0 8/4	64K	o	o	48	1
	iSBC 80/20-4 \$865	-	8080A 2.15	8/16	8/0 4/4	64K	o	o	48	1
	iSBC 80/16 \$540	-	8080A	8/16	64/0 32/2	64K	-	o	48	1
	iSBC 80/10B \$540	-	8080A 2.05	8/16	16/0 4/1	64K	-	o	48	1
	iSBC 80/05 \$435	-	8085A 1.97	8/16	4/0 .5/.5	64K	o	o	22	1



# Single Board Computers

Counter Timers (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
4/16	8/-	-	-	Price includes floppy disk controller; optional: Am9511.
4/16	8/-	-	-	Fully populated, includes parity, Am9511, floppy disk controller, Winchester and streamer interface, IEEE 488 interface, 16 CIP sw positions, RS-422/RS-423.
4/16	8/-	-	-	Price includes floppy disk controller, hard disk and tape interfaces; optional: Am9511, RS-422/RS-423.
3/16	8/-	-	-	Price includes floppy disk controller and Am9511.
3/16	8/-	-	o	Memory-mapped I/O; MC68451 MMU; Winchester interface; streaming tape interface.
6/16	23/30	-	2	Provides 4 universal memory site expansion, high integration provides single board system.
3/16	9/28	-	2	iSBC 304 Multimodule provides 128 Kbytes of dual-port RAM expansion, \$900. Optional numeric data processor with iSBC 337 Multimodule processor board, \$337.
3/16	16/23	-	2	iSBC 341 provides 4 universal memory site expansion, 80287 numeric processor socket provided.
3/16	9/28	-	2	iSBC 300A Multimodule provides 32Kbytes of dual-port RAM expansion, \$600. Optional numeric data processor with iSBC 337 Multimodule processor board, \$337.
3/16	9/18	-	-	iSBC 300 Multimodule provides 32K of dual port RAM expansion, \$500. Optional numeric processor with iSBC Multimodule processor board, \$337.
3/16	9/24	-	2	Optional numeric data processor with iSBC 337 Multimodule processor board, \$337. Optional iSBC Z41 64K EPROM expansion, \$150.
3/16	9/26	-	3	Multimaster or intelligent slave, 12-bit 20KHz A/D with PGA, 16 diff. or 32 SE. On-board programming of 2816 E <sup>2</sup> PROMS, optional 8087.
3/16	9/24	-	2	
3/16	12/18	-	-	
3/16	12/23	-	2	
3/16	8/26	-	-	
1/-	1/12	-	2	Limited Master.
1/-	1/11	-	1	Limited Master.
1/14	4	o	-	

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# Single Board Computers

Manufacturer	Model/ Price	DFA Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	DMA	Parallel (RS-232) I/O Lines	Ports
Logitech, Inc. .... (415)326-3885	PY8610 \$1490	9/82 2wk	8086 5,8	8-16/24	32/8 128/128	16M	o	o	8	1
Matrox Electronic Systems.. (514)735-1182	ZBC-80 \$1045	- -	Z80A 4	8-16/	40/- 64/16	64K	o	o	48	1
	PBC-80 \$1365	- -	Z80A 4	8-16/16	128/- 64/-	16M	o	-	24	2
	MBC-86/12 \$1995	- -	8086 5,8 or 10	16/20	32/- 128/128	1M	o	o	24	1
MBI, Inc. .... (617)964-1399	Perfect Slave \$2300	12/81 -	Z80A/B 4,6*	8/16	32/- 256/128	256K	o	o	16	4
	Perfect Slave \$2587	3/82 -	8086 8,10*	8-16/24	32/- 1M/128	16M	o	o	24	4
Measurement Systems ..... (714)633-4460	SBC-3200 \$1990	-	68000 12.5	-/24	-/- 1M/256	16M	-	-	-	-
Metacomp, Inc. .... (619)578-9840	MPA2000-0 \$3025	3/83 30da	iAPX-286 8	16/24	64/- 128/-	16M	o	o (8ch.)	o	1
Microbar Systems, Inc. .... (415)964-2862	GPC86-532 \$1195	2/81 1wk	8086 5,8*	8-16/20	32/- 128/32	1M	o	-	24	1
	C86-54 \$995	12/80 1wk	8086 5,8*	8-16/20	32/- 4/4	1M	o	-	-	1
	DBC86-50 \$1225	3/82 1wk	8086 5,8*	8-16/24	32/- 4/-	16M	o	-	24	2
	DBC68K-80 \$1595	3/82 1wk	68000	8-16/24	32/- 4/-	16M	o	-	24	2
	DBC286M \$1995	4/83 30da	80286 8	8-16/24	32/- 4/-	16M	o	-	24	2
	DBC68K2 \$1995	4/83 30da	68000 8*,10,12	8-16/24	128/- 512/128	16M	o	o	-	2
	DV286 \$2495	4/83 30da	80286	8-16/20	32/- 128/128	1M	o	-	24	1
Micro Designs, Inc. .... (404)493-6318	Miltibox \$1595	*12/83 stk	8085A-2 4.8	8/16	64/- 32/4	64	-	-	48	1
Micro Industries ..... (614)895-0404	MIB80/04 \$282	5/83 stk	8085 2	8/16	4/- 256/-	-	-	-	22	1 (14 TTL)
	MIB80/05 \$500	5/83 stk	8085 2	8/16	4/- 512/-	-	-	-	22	1 (14 TTL)

# Single Board Computers

Counter Timers (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
2/16	8/19	-	2	128Kbytes of dual-port memory with parity. 8087 add-on, operates without wait states. With LX 350-PIO, user can add 24 programmable I/O lines.
6/16	16/16	-	-	Optional Am9511/Am9512 APU; Operates without wait states.
5/16	16/-	-	2	On-board Management Unit.
3/16	8/8	-	-	128Kbyte and 64Kbyte versions available.
4/8	1/8	-	-	Configurable as intelligent slave. APM, Multibus and CPM compatible; dual-port RAM.
8/16	8/8	-	-	Configurable as intelligent slave or service processor. APM, Multibus and CPM compatible. Dual-port RAM. Memory management.
-/-	8/-	-	-	Software programmable baud rate 2RS-423 ports. Full UNIX III implementation.
6/-	16/28	o	2	80130 OSF, 8 DMA Channels, 128KRAM with Parity (64K DUAL PORTED) extremely flexible architecture allows operation as CPU, intelligent I/O processor or various combinations. MetaPaket architecture.
3/16	8/16	-	-	Optional CPU memory management, MM86; 8087 floating point processor.
-/-	1/11	-	-	Optional CPU memory management, MM86, 8087 floating point processor. 30 sq. in. breadboard area.
3/16	8/12	-	-	Features Dual Bus interface; optional: 8087 and MM86; dual-ported 0.5Mbyte no-wait state RAM card optional.
3/16	18/22	-	-	Dual-ported 0.5Mbyte RAM card; optional: up to 8 DBR50 cards provide 4Mbyte of RAM; MMU 68451 optional; supports bus vectored interrupts.
3/16	8/12	-	-	Features Dual Bus interface; opt. 80287; dual port 0.5 Mbyte; 2 wait state RAM cards optional.
3/16	18/22	-	1	Opt. MMU's; SUN Style or 68451; dual lens for 2Mbytes + high speed dual-port RAM; byte and word reversing control; mailbox int. & reset.
3/16	8/16	-	-	Optional 80287 floating point processor.
3/16	12/9+	-	2	SBC 80/24 software compatible single board computer with prototype area for 40 16-pin DIPs in a desktop rackmount cabinet with power supply.
-	-	-	-	Single board computer SBC80/04 compatible.
-	-	-	-	Single board computer. See SBC80/04.

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# Single Board Computers

Manufacturer	Model/ Price	DFA Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	DMA	Parallel (RS-232) I/O Lines Ports
Midwest Micro-Tek, Inc. ...	PC-85/20M \$445	10/82	8085	8/	32/2 32/2	-	-	-	24 1
	PC-88/12M \$1195	10/82	8088	16/	8/2 64/-	1M	o	-	22 1
Monolithic Systems Corp. ... (303) 770-7400	MSC 8001-07 \$630	- stk	Z80A 4	8/16	16/- 8/4	64K	-	o	48 1
	MSC 8004-47 \$995	- stk	Z80A 4	8/16	32/- 64/64	64K	o	o	48 1
	SC 8007-41 \$995	- stk	Z80A 4	8/16	32/- 64/64	64K	o	o	24 3
	MSC 8009-86 \$1219	- stk	Z80A	8/16	32/- 64/64	64K	o	o	- 2
	MSC 8017-01 \$1116	*11/83	Z80B 6	8/16	32/- 128/128	64K	o	-	24 3 48* 1*
	MSC 8186-01 \$2280	*10/83	80186 8	16/24	128/- 512/128	16M	o	o	24 1
	BLC-86/30 \$-	stk	8086 5, (8) *	16/20	64/- 256/128	1M	o	-	24 1
National Semiconductor .... See Sales Office Listing	BLC-86/05 \$1600	- stk	8086-2 5 or 8	16/20	16/8 128/-	1M	o	o	24 1
	BLC-86/12B \$1700	- stk	8086 5	16/20	32/- 64/32	1M	o	o	24 1
	BLC-80/316 \$760	- stk	Z80A 4	8/16	8/- 16/16	64K	o	-	48 1
	BLC-80/05 \$405	- stk	8085A 2	8/16	8/- .5/.5	64K	o	o	22 1
	BLC-80/10 \$448	- stk	8080A 2	8/16	4/- 1/1	64K	-	-	48 1
	BLC-80/11 \$395	- stk	8080A 2	8/16	8/- 1/1	64K	-	-	48 1
	BLC-80/11A \$395	- stk	8080A 2	8/16	32/- 1/1	64K	-	-	48 1
	BLC-80/14 \$465	- stk	8080A 2	8/16	8/- 4/4	64K	-	-	48 1
	BLC-80/14A \$465	- stk	8080A 2	8/16	32/- 4/4	64K	-	-	48 1
	BLC-80/24 \$875	- stk	8085A-2 4.8	8/16	32/- 4/4 8/8*	64K	o	-	48 1
	BLC-80/204 \$750	- stk	8080A 2	8/16	8/- 4/4	64K	o	-	48 1



# Single Board Computers

Counter Timers (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
-	-	-	1	Compatible with iSBC 80 family.
1/16	9/-	-	-	Socket for 8087 math processor, includes dual-density dial controller.
3/16	9/10	-	-	2 memory maps. Dual-port RAM/ROM.
3/16	9/11	o	o	2 memory maps. Optional APU dual-port RAM/ROM.
3/16	9/13	-	-	Same as above + 20-bit address recognition.
3/16	9/10	-	-	Includes on-board floppy disk controller; Optional: Am9511A APU. 2 memory maps, dual-port RAM/ROM. Optional CP/M.
3/16	9/13 9/11*	*	-	4 memory maps. Optional APU, dual-port RAM/ROM, 24-bit address recognition, individual board reset.
6/16	8/31	*	2	Optional math co-processor, dual-port RAM, optional CP/M iRMX 86.
3/16	9/28	-	2	Alternate source for iSBC 86/30, 20 mo. warranty.
3/16	9/24	-	2	Alternate source for iSBC 86/05, 2X PROM space. 12 mo. warranty.
3/16	9/21	-	2	Alternate source for iSBC 86/12, 2BLX connectors, 128K PROM space. 12 mo. warranty.
3/16	9/21	-	-	4MHz Z80 CPU, 12 mo. warranty.
1/14	4/12	o	-	Alternate source for iSBC 80/05, 2X more PROM space & 4K more RAM. 12 mo. warranty.
1/1	1/11	-	-	Alternate source for iSBC 80/10. 12 mo. warranty.
1/1	1/11	-	-	BLC-80/10 with 2X PROM space. 12 mo. warranty.
1/1	1/11	-	2	Alternate source for iSBC-80/10B. 12 mo. warranty.
1/1	1/11	-	-	BLC-80/14 with more RAM. 12 mo. warranty.
1/1	1/11	-	-	BLC-80/11A (iSBC 80/10B) with more RAM. 12 mo. warranty.
3/16	12/23	-	2	Alternate source for iSBC 80/24. 12 mo. warranty.
3/16	8/26	-	-	Alternate source for iSBC 80/20-4. 12 mo. warranty.

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# Single Board Computers

Manufacturer	Model/ Price	DFA Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	Parallel DMA I/O Lines	(RS-232) Ports
NEC Electronics U.S.A. .... (617) 655-8833	BP0186 \$1595	1/81 stk	8086 5,8	16/20	64/- 128/-	1M	o	-	24 1
	BP0180 \$1040	1/83	Z80A 4,2.5	8/20	32/- 8/4	1M	o	-	48 1
	BP0185 \$1040	1/83	8085A-2 5,2.5,1.25	8/20	16/- 8/8	1M	o	-	24 2
	BP0188 \$2095	4/82	8088	8/20	48/- 128/32	1M	o	-	24 1
Omnibyte Corporation .....	OB68K1A \$1995	6/81 6wk	68000 10	16/32	96/- 128/128	16M	o	o	40 2
	OB68K/MMU \$2495	6/83	68010 10	16/24	32/- 4/-	16M	-	o	2
Pacific Microcomputers .... (619) 436-8649	PM68K8 \$1990	9/81 stk	68000 8 or 10*	16/24	32/8 256/128	8M	o	o	16 2
	PM68D8 \$3290	9/82 2wk	68000/68010 10	16/24	128/16 256/256	24M	o	o	24 2
Plessey Microsystems .....	PMM 68K \$-	6/82 6wk	68000 8	16/24	-/- -/-	16M	o	o	16 2
PPM Inc. ....	PPM-86-50 \$695	6/83 -	8086 (5,8,10)	-/-	128/- 128/-	-	-	-	12 1
Raster Graphics Inc. .... (503) 620-2241	RG-801 \$495	9/82 stk	Z80A 4	8/16	16/4 8/8	64K	o	-	16 2
	RG-802 \$695	3/83 -	Z80A 4	8/16	4/4 64/64	64K	o	-	- 2
Relms .....	RSbc-Z80/32 \$1095	- -	Z80A 4	8/24	16/- 32/32	16M	o	-	- 2
SBE, Inc. ....	M68K10 \$1695	2/83 4wk	68000 10	16/24	64/- 128/128	16M	o	-	24 2
SGS Semiconductor Corp. .... (602) 867-6100	SAM803 \$2500	- 2-4wk	Z8003	16/	-/- 512/128	2M	-	2	1 2

# Single Board Computers

Counter Timer (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
2/16	8/16	-	-	Optional 8087 math processor and PROM resident monitor/debugger; 128K, 32K, or 0Kbytes of RAM.
2/16	9/20	-	-	1Mbyte system memory addressing; shadowing capability, optional CMOS RAM for battery back-up.
1/16	13/17	-	-	1Mbyte system memory addressing; shadowing capability, 8-bit on-board general input port.
-	8/8	-	-	Optional PROM resident monitor; supports NEC's ADC <sup>TM</sup> Bus.
3/16	7/-	-	-	128Kbyte version \$1995. Dual-ported.
1/24	7/-		0	
5/16	7/-	o	-	Two level memory management; no-wait states with on-board RAM; expandable to 512Kbytes; +5 volts only. Languages and operating systems available.
6/16	7/-	o	-	Dual-port no-wait state RAM expandable to 8MB; parallel I/O port for SASI, QIC II, or Centronix; Mailbox interrupts; hardware refresh, RS-422 & 423. No-wait state memory management.
3/16	7/-	o	-	Includes UNIX port, internal diagnostics, MMU, segment page re-location, IEEE floating point processor optional.
-	8/-	-	-	96 buffered I/O lines. Real-time clock/calendar. 2 programmable time base interrupt generations.
-/-	8/8	-	-	Built-in debugger, trace program execution, disassemble object code, set breakpoint in RAM. Uses 2732 PROM for debug, upload-download Intel hex-format.
-/-	8/8	-	-	Double density floppy disk controller, shadow PROM for CP/M 2.2.
-/-	8/12	o	-	
3/16	8/-	-	2	Dual-ported memory, no-wait states; plug-on MXM10 module doubles RAM to 256Kbyte; multiprotocol serial ports; optional 16Kbyte CMOS RAM with external back-up. Tripple 16-bit counter timer.
-/-	-/-	-	-	Interface through P <sub>1</sub> and P <sub>2</sub> connectors, DMA channels activated with optional Z8016 <sup>1</sup> DMA controller chip supports multiple programs and memory.

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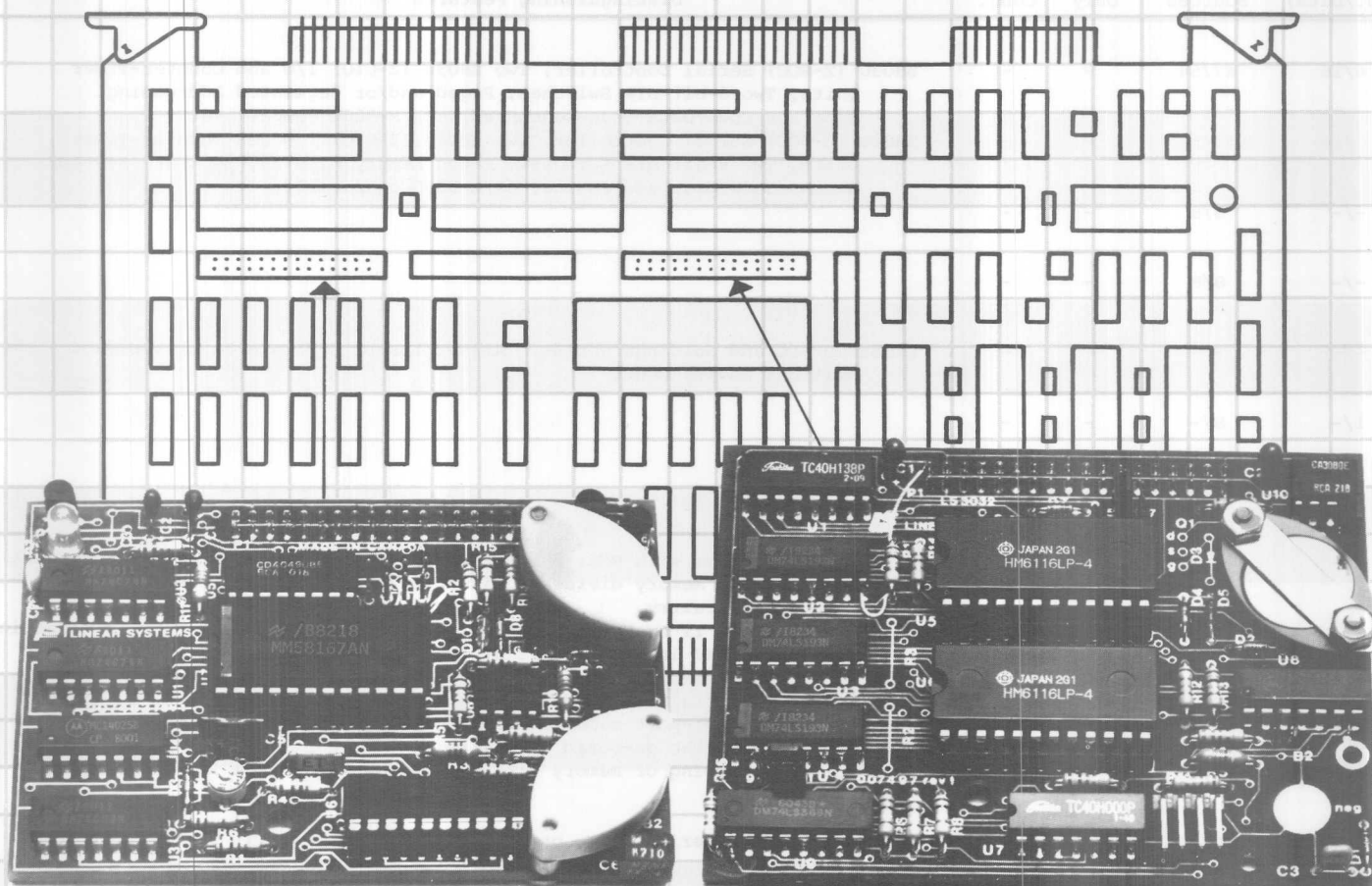
# Single Board Computers

Manufacturer	Model/ Price	DFA Deliv.	CPU/Clock Speed (MHz)	Data Bus/ Address (bits)	Cap./Supplied (Kbytes) ROM RAM	Total Add. (bytes)	Multi- master	Parallel I/O Lines	(RS-232) Ports
Single Board Solutions .... (408) 253-0181	MB8001 \$1195	4/83 -	Z8001 4 or 6	16/24	128/- 176/32 176/128*	8M	o	-	40 2
	MB8002 \$1195	4/83 -	Z8002 4 or 6	16/20	128/- 176/32 176/128*	1M	o	-	40 2
Systemathica .....	MBC 8001 \$350	-	8080A 4	16/20	64/- 64/-	64K	-	-	48 4 8*
	MBC 16001 \$750	1	8086 5 or 8	16/20	64/- 64/16	1M	-	-	24 1 8*
	DBC 18XX	-	iAPX 188 -	16/24	64/- 256/64	-	-	o	24 1
Thomas Engineering Co. .... (415) 680-8640	MZ-80 \$1200	6/82 -	280B 2.5,5,6	-/-	4/- 32/-	-	-	-	12 2
	MZ-68K \$2000	4/83 -	68000	-/-	128/- 128/-	-	-	o	- 2
TTTN, Inc. .... (415) 348-9181 (612) 831-4422	TN/6831 \$2100	80 6wk	6809 .9,1.3,1.8	-/20	32/- 16/16	1M	o	o	- 1
	TN/6844 \$2100	81 6wk	6809 1.1,1.4,1.8	-/20	32/- 16/16	1M	o	-	14.2 4
	TN/6835 \$2600	7/82 8wk	6809 1.1,1.4,1.8	-/24	32/- 64/64	16M	o	o	48 2
	TN/68K30 \$3750	7/82 10wk	68000 8	16/24	64/0 128/128	16M	o	-	- 2
	TN/86/40 \$3600	7/82 10wk	8086 5/8	16/24	32/- 128/128	16M	o	-	24 3
TSD Display .....	M60139/ 60141 \$2495	- stk	68000 8	16/20	32/4 256/128	1M	-	-	- -
Zendex Corporation .....	ZX-86 \$1545	- stk	8086 5,8,10	16/20	64/- 8/8	1M	o	o	24 1 2*
	ZX-80/15 \$550	- stk	8085A-2 2 or 5	8/16	32/- 2/1	64K	o	o	22 1
	ZX-85 \$2660	- stk	8085A-2 5	8/16	2/2 64/64	64K	o	o	- 2
	ZX-88 \$2750	- stk	8088 5	8/20	2/2 64/64	1M	o	o	- 2
	ZX-82 \$1995	- stk	28002 4	16/16	8/8 32/32	64K	o	o	24 2
	ZX-86/87 \$1832	- stk	8086/87 5	16/20	64/- 8/8	1M	o	o	42 1 2*
	ZX-186 \$-	- stk	80186 8	16/24	64/- 256/128	16M	o	o	24 1 2*



Counter Timer (No./bits)	Interrupt Levels/ Sources	+5V Only	SBX Conn.	Distinguishing Features
6/16	47/54	-	-	Z8030 (Z-SCC) Serial Controller, Two Z8036 (Z-CIO) I/O and Counter-Timer Units, Two 8-bit DIP Switches, Paged and/or Segmented Addressing. Separate Code/Data (non-segmented), CP/M-8000 compatible.
6/16	47/54	-	-	Z8030 (Z-SCC) Serial Controller, Two Z8036 (Z-CIO) I/O and Counter-Timer Units, Two 8-bit DIP Switches, Paged Memory Mapping, Separate System/Normal/Code/data addressing, CP/M-8000 compatible.
-/-	8/8	-	-	
-/-	8/8	-	-	
-/-	-/-	-	-	Links IBM-PC and Multibus worlds. Allows IBM-PC software to be run in a Multibus environment.
1/-	8/-	-	-	
3/-	-/-	-	-	
1/-	8/-	-	-	2 HDLC serial lines with DMA; 8 interprocessors IT by Multibus transfer; dual-port memory. Memory divided in 4Kbytes mapped into addresses by the on-board circuitry.
2/-	8/-	-	-	8 interprocessors IT by Multibus transfer; dual-port memory; memory divided in 4Kbytes mapped into addresses by the on-board circuitry.
2/-	8/-	-	-	Multiprotocols serial lines (async-bits); 8 interprocessors IT by Multibus transfer, dual-port memory. Memory divided in 4Kbytes mapped into addresses by the on-board circuitry.
3/16	14/28	-	1	Dual-port RAM mapping of memory with resolution of 64bytes in off-board request.
3/16	9/26	-	1	One asynchronous serial line; one asynchronous HDLC serial line.
3/-	7/-	-	-	
3/16	8/8	-	3	Socket for optional 8087 numeric processor. Software transparent to Intel iSBC-86/05. Optional dual SIO provides 2 serial ports.
1/14	4/15	-	3	Software compatible with Intel iSBC-80/05 and iSBC-80/10B.
3/16	16/15	-	-	May be converted to ZX-88. Intel MDS IPB-80 and IPC-85 compatible.
3/16	16/15	-	-	May be converted to AZ-85.
5/5	8/24	-	-	32K dual-port RAM.
3/16	8/8	-	3	Same as ZX-86 but includes 8087 co-processor.
6/16	11-64/25	-	2	Fully compatible with the SBC/XX boards. No-wait states. With 256KBRAM. Two DMA channels.

# 2 NEW SBX FUNCTIONS



## LS 7482

### CALENDAR CLOCK

- On Board power fail protection
- Two programmable Interrupts
- One Year Calendar-time to 1/1000 sec.
- Based on the National MM58167A

It's a reliable timekeeper with many extras. For instance on board power fail detection protects time data without CPU overhead. Programmable alarm functions are available as interrupt outputs, or from a status read.

## LS 3032

### BATTERY BACKUP MEMORY

- 5 Year Data Retention with Li cell
- Protects Critical Data on Power down
- Speed Limited only by Port Access Time
- 4 K byte capacity

This non-volatile memory allows critical data to be retained in spite of power failures. A read or write to the port automatically increments the address pointer for the highest possible data transfer rate.

## FOR MORE INFORMATION WRITE OR CALL

USA: INDUSTRIAL MODULES INC. 24G - 1400 COLEMAN AVE. SANTA CLARA CA 95050 (408) 988-1911  
CANADA: LINEAR SYSTEMS 1122 SANFORD ST. WINNIPEG, MB R3E 2Z9 (204) 774-7991

# SBX Expansion Modules

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Abionics Incorporated  
Advanced Micro Devices  
Centigram Corp.  
Century Computer Corporation  
Diversified Technology Inc.  
ETI Micro  
General Digital Corp.  
Intel Corporation  
Linear Systems Ltd.  
Logitech, Inc.  
Matrox Electronic Systems  
Medinova Corporation  
Micro Designs, Inc.  
Modular Integration, Inc.  
National Instruments  
National Semiconductor Corp.  
Northern Precision Laboratories, Inc.  
Procise Corporation  
R & D Electronics (Pty) Ltd.  
SBE, Inc.  
TITN, Inc.  
Zendex Corporation  
Ziatech Corporation

## SBX Expansion Modules

Manufacturer	Model	Price	DFA Deliv.	Type	Compatibility/ Features
Abionics Incorporated ... (201) 386-9785	MX201A	\$295	4/83 stk	Clock/Calendar	14 digits of date and time with periodic interrupts. 5V only and RMX-86 driver optional.
	MX-301	\$380	★10/83	Dual RS-232 Interface	Single width, selectable baud rate. Modem control and jumper selection of DTE or DCE. RMX-86 driver optional.
	MX-501	\$280	★10/83 stk	Interrupt & Timer Counter Expansion	Provides 8259A for local interrupt expansion with buffered inputs. 8254 timer counter. Clock & control selectable.
AMD ..... (408) 988-7777	94/1530	\$395	6/83 stk	Dual Serial RS-232C Ports	On-board Z8530 SCC provides two independent serial ports.
	94/1541	\$395	★9/83 stk	Stepper Motor Con- trollers	Controls 4-phase stepper motor. Includes 15 lines of feedback.
Centigram Corp. .... (408) 734-3222	TIM	\$650	-	Voice Synthesizer Module	
Century Computer Corp. ... (214) 233-3238	V8009	\$800	-	128K Memory	250ns Access time. 450ns cycle time. Byte swap for 8/16 bit. 5 volts only
	V8004	\$450	stk	Floppy Disk Controller	Supports 5 $\frac{1}{4}$ " and 8" drives, single or double sided/density. 5V only. Uses 8272 chip and digital P.L.O. data separator
	VM804	\$600	30da	Serial I/O Expansion	Single-wide card. 4 RS-232 channels, 3 programmable baud rates, start/stop bits and parity. 5 volts only.

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## SBX Expansion Modules

Manufacturer	Model	Price	DFA Deliv.	Type	Compatibility/ Features
Diversified Technology .. Inc. (601)856-4121	CBX583	\$195	*10/83	Real-Time Clock Calendar	6 yr. lithium battery back-up. All CMOS periodic interrupt capability, 4 yr. calendar.
Douglas Electronics Inc.. (415)483-8770	12-DE-16-B	\$ 16	6/82 stk	Prototyping Expansion	iSBX system of on-board expansion; mounting holes align with SBC host board; general purpose breadboarding areas; I/O pads.
	12-DE-16-A	\$ 20	6/82 stk	Prototyping Expansion	Same as above except larger size; power and ground traces run directly to iSBX connector pins. (iSBX connector not included.)
ETI Micro ..... (415)829-6600	5400	\$420	*12/83	Bell 202/103 Modem	Software selectable, baud rates to 1200 baud, CCITTI, V.21, V.23.
General Digital Corp. ... (203)528-9041	GDX- PROTO-1	\$ 60	- stk	Prototyping Expansion	Replaces BLX - 391; includes 72 pin I/O connector. Expansion connector.
	GDX- SPEECH-TI	\$285	10/82 stk	Voice Synthesis	Employs TI-5220 (LPC-10) chip; includes 206 word vocabulary.
	GDX- RELAY-8	\$120	9/82 stk	Relay Output	Allows for 8 Form-A or C relays.
	GDX- NVRAM-256	\$240	10/82 stk	Non-Volatile Memory	Non-volatile RAM/E <sup>2</sup> PROM 256bytes. No battery required.
	GDX- COLOR-1	\$245	6/83 stk	Color Alphanumeric/ Graphics	Employs TI-9918A video display processor 256 x 192 pixels, 16K RAM & self refresh.
	GDX- SERIAL-25	\$160	*11/83	Dual Serial RS-232C Ports	2 EIA RS-232C Channels; Utilizes 8251A USART.
Heurikon Corporation .... (608)271-8700	S10-SCCA	\$295	-	Serial I/O Expansion	4 RS-232C ports. Each port has separate baud rate generator. Sync or async.
		\$395	-	Floppy Disk Expansion Module	Piggyback. Supports 5¼" or 8" single or dual sided/density.

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## SBX Expansion Modules

Manufacturer	Model	Price	DFA/ Deliv.	Type	Compatibility/ Features
Intel Corporation ..... See Sales Office Listing	iSBX311	\$610	-	Analog Input	16 channels (8 diff.), 12-bit resolution, 50 usec conversion time. iCS 910 termination panel.
	iSBX328	\$750	-	Analog Input	8 channels, 12-bit resolution, utilizes Intel UPI-41 as intelligent prog. mux.
	iSBX488	\$650	-	IEEE 488 (GPIB)	15 talker, listener or talker/listener devices.
	iSBX2178	\$495	-	1/4" Magnetic Tape Interface	Capatible with QIC-02 streaming or HCD-75 or start/stop drives.
	iSBX218	\$540	-	Flexible Disk Controller	Single or double sided and density, on-board data separator, for 8" and 5 1/4".
	iSBX270	\$750	-	Video Display Controller (DW)	B&W or color, Alphamosaic CRT/Keyboard.
	iSBX275	\$995	-	Video Graphics Controller	B&W or color graphics, uses i82720 (GDC)
	iSBX331	\$350	-	Fixed/Floating Point Math	Intel 8231 APU at 4MHz; floating point 32-bit.
	iSBX332	\$350	-	Floating Point Math	
	iSBX350	\$155	-	Programmable Parallel I/O	24 programmable I/O lines, +5V only.
	iSBX251	\$895	-	Bubble Memory Expansion	Auto error detection correction; 48 ms access times 100 Kbps burst data rate.
	iSBX251C	\$695	-	Bubble Memory Expansion	Same as iSBX-251 except operates from 10° to 40° C.
	iSBX351	\$230	-	Programmable Serial I/O	Two programmable 16-bit BCD/binary timers.
	iSBX352	\$395	-	Programmable Communications	HDLC/SDLC, half/full duplex; point-to-point multidrop; NRZI SDLC loop; RS-232C and RS442A/449 interface.
Linear Systems Ltd. .... (204) 774-7991	LS7482	\$330	5/82	Calendar Clock	Single-wide, 1 year calendar, Programmable alarms.
	LS3032	\$330	1/83	Battery Backup Memory	4 Kbytes, 5 year lithium cell.

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## SBX Expansion Modules

Manufacturer	Model	Price	DFA/ Deliv.	Type	Compatibility/ Features
National Semiconductor .. See Sales Office Listing	BLX-321	\$400	stk	Analog Output	10-bit resolution.
	BLX-350	\$155	stk	Programmable Parallel I/O	24 I/O lines.
	BLX-351	\$230	stk	Programmable Serial I/O	RS-232C or RS-449/422 operation.
	BLX-391	\$100	stk	Prototyping Module	Up to 14 16-pin devices.
	BLX-281A & B	\$170	stk	Speech Synthesis Module	144 Word vocabulary.
	BLX-331	\$350	stk	Fixed/Floating Point Math	4MHz single/double precision 32-bit floating point and transcendental functions.
	BLX-355	\$380	stk	Dual Channel Protocol Controller	SDLC/HDLC/ADCCP or bi-sync operation. Use with any board with BLX/iSBX.
	BLX-218		stk	Floppy disk Controller	Single or double density up to 4 drives with 8 surfaces.
Northern Precision Labs.. (201) 227-4800	NPX-2000	\$375	★8/83 4wk	Clock, RAM and I/O Module	16K battery back-up. CMOS RAM. 16K EPROM Expansion. 12 optically isolated outputs. 8 TTL I/O Lines.
ProCise Corporation .....	ARX-429	\$795	8/81 10wk	ARINC-429 Transceiver	Double wide; 8 16-bit; 2 receive channels and 1 transmit channel
R&D Electronics(PTY)Ltd.. (011)834-1204/5 (South Africa)	QBX-PCC	\$320	1/82	Parallel I/O-Clock-Julian Calendar	On-board standby NiCad battery and up to 13 buffered I/O lines.
	QBX-FOG/C	\$362	3/82	Non-volatile CMOS Memory	256bytes organized as a stack. Stack pointer fully programmable. Standby voltage required.
	QBX-FOG/E	\$455	5/82	Non-volatile RAM Memory	64 or 256bytes with shadow EPROM organized as a stack. +5V only (no standby)
	QBX-MSP	\$522	8/82	Serial I/O	Double wide SBX, 2 or 4 serial async. parts; prog. baud rate; RS-232C.
	QBX-TMR	\$407	4/83	Timer-Counter	5x 16-bit timer/counters; used AMD9513, inputs overvoltage protected. Outputs buffered.
	QBX-FST	\$303	★10/83	Fail Safe Timer	2 fail safe monostable timers, gated for reset or interrupt. Warm/Cold start detection. Visual failure LED's.
	QBX-QBX	\$550	★9/83	4SBX Connector Motherboard	Allows up to 4SBX Modules, memory or I/O mapping.

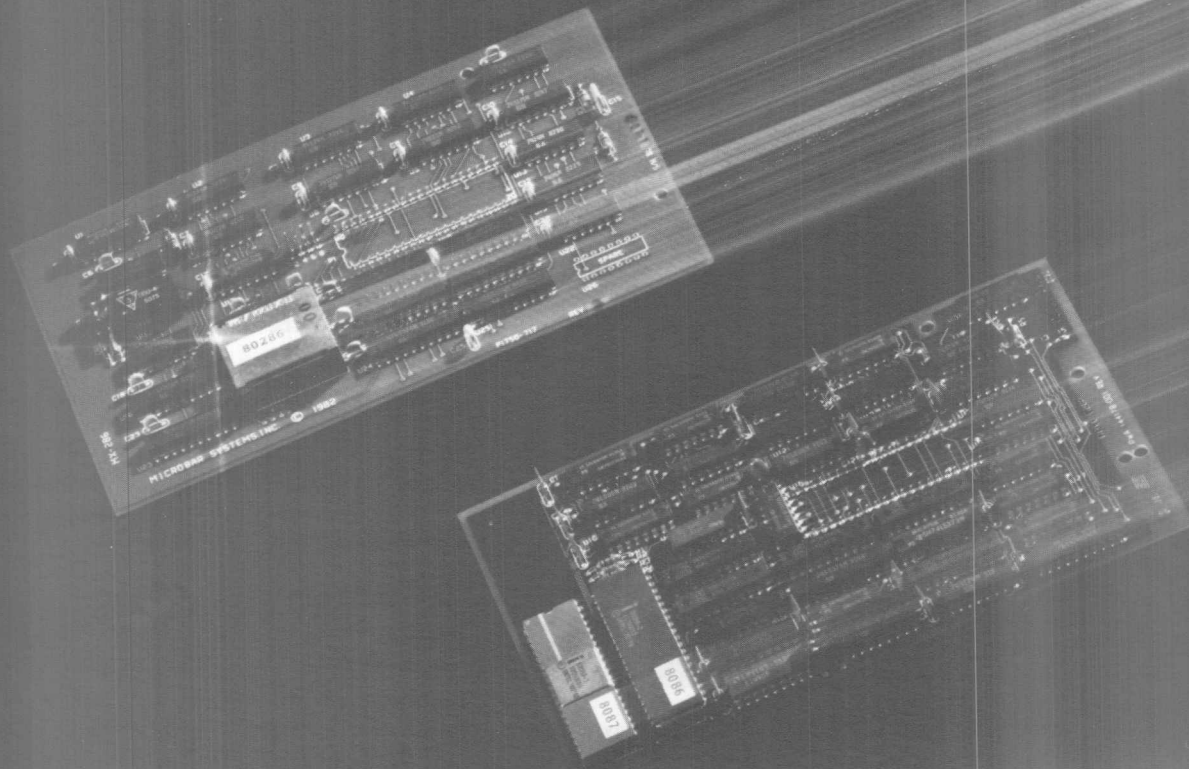
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## SBX Expansion Modules

Manufacturer	Model	Price	DFA/ Deliv.	Type	Compatibility/ Features
SBE, Inc. .... (415) 652-1805	SBEX-SASI	\$295	2/83	SASI Bus Interface	Single width; supports DMA; inter- face to disk and tape controllers.
TITN, Inc. .... (415) 348-9181	TNBX-05	\$650	-	Programmable Communica- tions Controller	Two async/sync/HDLCD/SDLC/full duplex lines, RS-232C.
	TNBX-06	\$1300		Video Controller	One Mega Pixel B & W graphics uses NEC 7720 GDC.
Zendex Corporation ..... (415) 828-3000	ZBX-218B	\$480	8/81 stk	Flexible Disk Con- troller	Single/double density-side 8" or 5¼", single or dual sided drives.
	ZBX-324	\$291	7/81 stk	Analog I/O	Two 8-bit ADC and two 8-bit DAC iSBC-80/10B. 80/24 +5V only.
	ZBX-351	\$209	- stk	Serial I/O	RS-232C, 449/421, one channel, uses 8251 with 8253 timer.
	ZBX-350	\$141	7/81 stk	Parallel I/O	24 lines, uses 8255A P10.
	ZBX-349	\$141	6/81 stk	Centronics Line Printer Interface	Includes printer interface cable.
	ZBX-348	\$320	1/83 stk	Time-of-Day Clock	Battery back-up, flexible periodic interrupts.
	ZBX-488	\$500	- stk	IEEE-488 Interface	Uses T.I. TMS-9914 GPIB controller.
	ZBX-391	\$85	1/82 stk	Prototyping Module	
	ZBX-901	\$195	- stk	Audio/Visual Display	Capable of displaying 6 hexadecimal digits. Audio transducer.
Ziatech Corporation ..... (805) 541-0488	zSBX-20	\$450	9/82 stk	GPIB Controller	Full function. Talker/Listener on "Piggyback" multimode board. Device drivers, software, and manual included.
	zSBX-30	\$150	5/83	Parallel I/O	Dual 8255 chips provide 48 programmable I/O lines. Optional interrupt and hand shaking manual included with example applications.

# NEVER HAS SO MUCH BEEN AVAILABLE SO SOON



## iAPX 286\* Overpowering Performance For 8086 Systems

Doubled execution speed and virtual memory without the normal time delay of a new CPU design.

The **Microbar MX286** gives you full iAPX 286 capability with 8 Mhz operation, up to 16 Megabytes physical address space, one Gigabyte virtual space, plus built-in memory management. And it all plugs into most existing 8086 sockets.

Doubled processing speed is immediate.

Using the virtual memory requires software changes. Microbar makes the changes easier with their iAPX 286 software Development Vehicle.

MX286 custom form factors are available with low cost, quick manufacturing turn-around.

\*iAPX286 is a trademark of Intel Corp.

## XENIX\* Style Hardware Memory Management

Multiuser hardware memory management designed to run Microsoft's Xenix on 8086 systems.

The MM86 gives you multiuser system performance with one megabyte addressing, memory protection, non-contiguous block mapping, up to 32 processes, plus an optional 8087 co-processor. And it plugs into most 8086 sockets.

The MM86 works with any bus structure.

Custom form factors are available with low cost, quick manufacturing turn-around. And of course OEM discounts are available.

The MM86 and MX286, from Microbar, are part of a family of CPU enhancing modules for leading 16 bit microprocessors.

\*XENIX is a trademark of Microsoft Corp.



For more information  
call or write today  
(415) 964-2862

# Expansion Cards (not SBX)

Advanced Micro Devices  
Intel Corporation  
General Digital Corporation  
Metacomp, Inc.  
Microbar Systems  
National Semiconductor Corp.  
Procise Corporation  
SBE, Inc.  
Zendex Corporation

## Expansion Cards (not SBX)

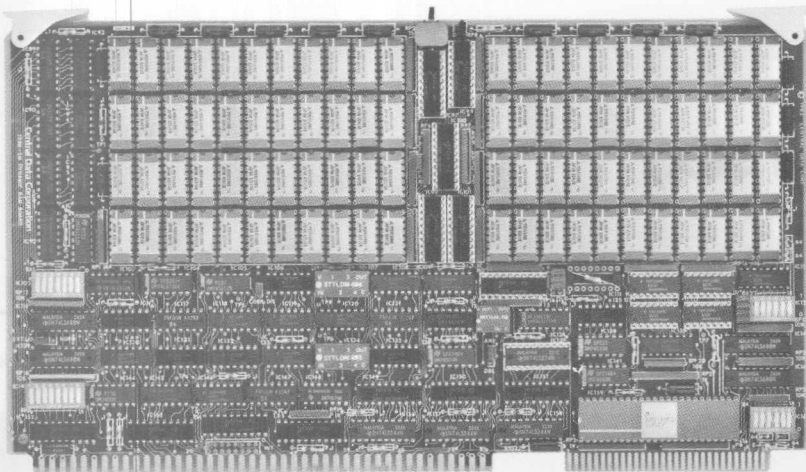
Manufacturer	Model	Price	DFA/ Deliv.	Type	Compatibility/ Features
AMD ..... (408)988-7777	97/0343	\$450	-	Memory Expansion Board (for 97/8605)	8K STATIC RAM, sockets for up to 64Kbytes of EPROM.
Intel Corporation ..... See Sales Office Listing	iSBC337	\$337	-	Numeric Data Processor	iSBC 86, 88, and iAPX 86, 88 systems. Utilizes Intel 8087.
	iSBC302	\$450	-	8Kbytes Static RAM	iSBC 86/05, 88/25. Expands memory to 16Kbytes.
	iSBC341	\$150	-	EPROM board	iSBC 86/05, 88/40, 88/25. Sockets for up to 64Kbytes.
	iSBC340	\$140	-	16Kbyte PROM	iSBC 86/12A.
	iSBC300	\$500	-	32Kbyte RAM	iSBC 86/12A.
	iSBC301	\$325	-	4Kbyte Static RAM	iSBC 80/24, 88/40.
	iSBC300A	\$600	-	32Kbyte Dynamic RAM	iSBC 86/14.
	iSBC304	\$900	-	128Kbyte Dynamic RAM	iSBC 86/30.
	iSBC305	\$615	-	RAM ECC Protection	iSBC 028A (RAM board)
	iSBC306	\$795	-	RAM ECC Protection	iSBC 056A (RAM board)
General Digital ..... (203)528-9041	PME-1	\$50	★10/83 stk	PROM Memory	Expand 1-24 Pin Socket into 3.

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## Expansion Cards (not SBX)

Manufacturer	Model	Price	DFA/ Deliv.	Type	Compatibility/ Features
Metacomp, Inc. .... (619) 571-1168	NDX2000	\$395	3/83 30da	Numeric Data Processor	Expansion module for iAPX-186 socket to allow addition of 8087 numeric data
	DBX2000	\$795	3/83	iAPX-186 Debug Tool	Debug tool to allow use of ICE-86 in-circuit emulator in iAPX-186 based design. Operates with METACOMP MPA-2000. 5MHz; C86, GPC86, DBC86 (Replaces Intel iSBC 308, 309)
Microbar Systems ..... (415) 964-2862	MM86-5	\$495	-	5MHz Memory Management	
	MM86-8	\$445	1/82 1wk	8MHz Memory Management	Same as MM86-5 except 8MHz.
	MM68K-SUN	\$695	4/83 30da	Page-Style Memory Management	For Microbar DBC68K2 SBC.
	MX286	\$995	4/83 30da	80286 in 8086 Socket	Any 8086 CPU board; C86, GPC86, DBC86.
National Semiconductor .. See Sales Office Listing	BLC-300	\$500	stk	32Kbyte RAM	Second source iSBC-300, use on 86/12B
	BLC-8302	\$450	stk	8K Static RAM	BLC 86/05
	BLC-337	\$337	stk	8087 Numeric Data Processor	Use on BLC-86/05, BLC-86/12B.
	BLC-304	\$-	stk	128K DRAM Module	BLC 86/30 and iSBC 86/30.
Proclise Corporation ..... (206) 392-0270	796 Bus Repeater	\$795	2/83 4wk	Bus Repeater	Repeats Multibus signals into additional card cages for expansion. 16-bit data 24-bit address.
SBE, Inc. .... (415) 652-1805	MXM10	\$495	3/83 4wk	128Kbyte Memory Expansion	Fits M68K10 to double fuston-board RAM; Optional 512Kbyte version.
TITN Inc. ....	TN68000-1	\$215	83 6wk	64K Static RAX	To 192K.
Zendex Corporation ..... (415) 828-3000	AX-343	\$425	4/83	Combo RAM and ROM	Fits on ZX-86, provides 8Kbyte RAM and 32Kbyte of expansion ROM
	XX-318	\$-	- stk	128DRAM-Parity	For 2X-186



## The industry's fastest Multibus\* memory boards (and the quietest) are at work.

### The new 128K-2MByte Dynamic RAM Boards from Central Data.

- Parity Only or Error Detection/Correction (EDC) versions
- High-Reliability Sockets with built-in decoupling capacitors
- 4- and 6-layer construction
- 230ns and 265ns access time
- Upgradable to 2 MByte on one board

#### Engineered for you

You told us that you wanted more speed and fewer noise problems from a complete line of Dynamic RAM boards. Central Data's EDC and Parity Only boards deliver just that and more. Our primary design objectives were speed and reliability, and we've achieved that by the unique combination of features engineered into these boards.

#### Spectacular speed

We can provide you with the fastest board available today. Our use of Garry Sockets™ has saved 12% of the board space, allowing room for a discreet RAM Controller that delivers incredible speed. In addition, the critical timing paths and the RAM array drivers are almost exclusively comprised of FAST IC's which provide up to 30% more speed.

#### High noise immunity

Dynamic RAM Boards are especially susceptible to noise problems. It is therefore essential that a heavy power and ground plane be run throughout the board and that an adequate number of bypass capacitors be used. Central Data's Dynamic RAM Boards have 4-layer and 6-layer construction, with at least 2 of the internal layers dedicated to power and ground.

#### Enhanced reliability

Our extensive use of Garry High-Reliability Quiet Sockets is one reason these boards stand out from the rest. They provide a 40% reduction of RAM associated noise as compared to any other conventional means of decoupling. Quiet sockets are used for the RAS, CAS, WE and address driver IC's to the RAM array and for all Dynamic RAM chips. Their machined pin "swiss screw" mechanisms eliminate failures from poor mechanical connections. They also allow field upgrading to the 256K RAM chips for a 2Mbyte Multibus Dynamic RAM Board.

#### Quality from the inside out

A tough Vaclel\*\* coating totally encapsulates all fine-line circuits and protects the board from handling abuse. And like Central Data's full line of Multibus boards, these new Dynamic RAM boards pass the industry's most rigorous diagnostic testing and burn-in before they're delivered to you.

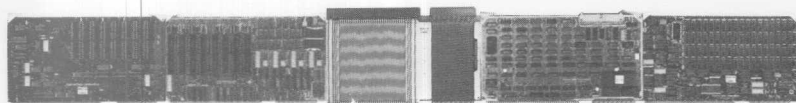
You'll find these quality features and more on the new 128K-2MByte Dynamic RAM Boards from Central Data. This commitment to performance, quality and reliability is the reason more and more successful OEMs are depending on Central Data as their complete Multibus source. Make Central Data your choice—call or write today for more information on our full line of quality Multibus boards.

## Central Data

Central Data Corporation  
1602 Newton Drive  
Champaign, IL 61821-1098  
(217) 359-8010  
TWX 910-245-0787

Your  
Complete  
Multibus\*  
Source

Quality from the inside out in a full line.



\*Multibus is a trademark of the Intel Corporation.  
\*\*Vaclel is a trademark of the DuPont Corporation.

## Dynamic RAM

Advanced Digital Technology  
Advanced Micro Devices  
Advant MicroSupport  
AIM Technology  
Central Data Corporation  
Century Computer Corporation  
Chrislin Industries  
Comark Corporation  
CYB Systems, Inc.  
Datacube, Inc.  
Densan Co., Ltd  
Edge Micro Systems  
Frontier Technologies  
Heurikon Corporation  
Intel Corporation  
Interactive Images, Inc.  
Intersil Systems  
Logitech, Inc.  
Matrox Electronic Systems  
Measurements Systems & Controls  
Microbar Systems, Inc.  
Micro Industries  
Micro Memory, Inc.  
Monolithic Systems Corp.  
Motorola  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Plessey Microsystems  
Questar Computer Systems  
Relms  
Texas Instruments  
Zendex Corporation  
Zitel Corporation

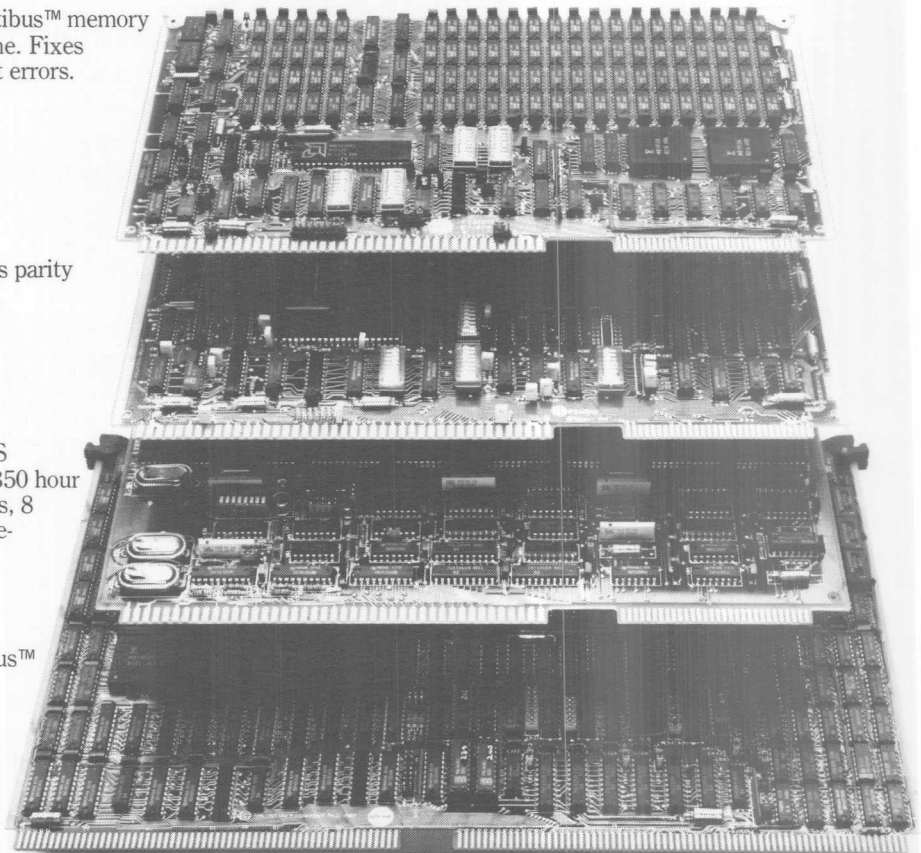
# THE BUS STOCKS HERE:

**PSM-512A:** 512 kbyte Multibus™ memory with ECC, 275 nsec access time. Fixes single-bit errors, flags multi-bit errors.

**PSM-512P:** 512 kbyte Multibus parity memory, 240 nsec access time. Very economical.

**PSM6463:** 64 kbyte non-volatile CMOS Multibus memory, 200 nsec access time. 350 hour standby with on-board rechargeable NiCd's, 8 years with lithium. For process control, telecommunications, other critical applications.

**NEW PSM1VA:** 1 megabyte VERSAbus™ memory with ECC, 300 nsec access time. Lots faster and much less expensive than Motorola and IBM equivalents. Full 32-bit VERSAbus compatibility.



If you're on board the Multibus or VERSAbus, we've got the memories you need to get where you're going faster, for less. ECC, parity and non-volatile CMOS. All in stock now, all with one thing in common. Their first name is Plessey.

And since Plessey makes them all, they all have high reliability, a one year warranty and Plessey support worldwide.

For more information, just contact Plessey

Microsystems, 451 Hungerford Drive, Rockville, MD 20850. (301) 279-2892, TWX 710-828-9815. Irvine, CA: (714) 540-9931.

In Europe, contact: Towcester, UK: (0327)50312, Telex 31628. Paris: 776 41 06. Noordwijk: (01719) 19207. Munich: (089)2362226. Rome: (06) 350189.

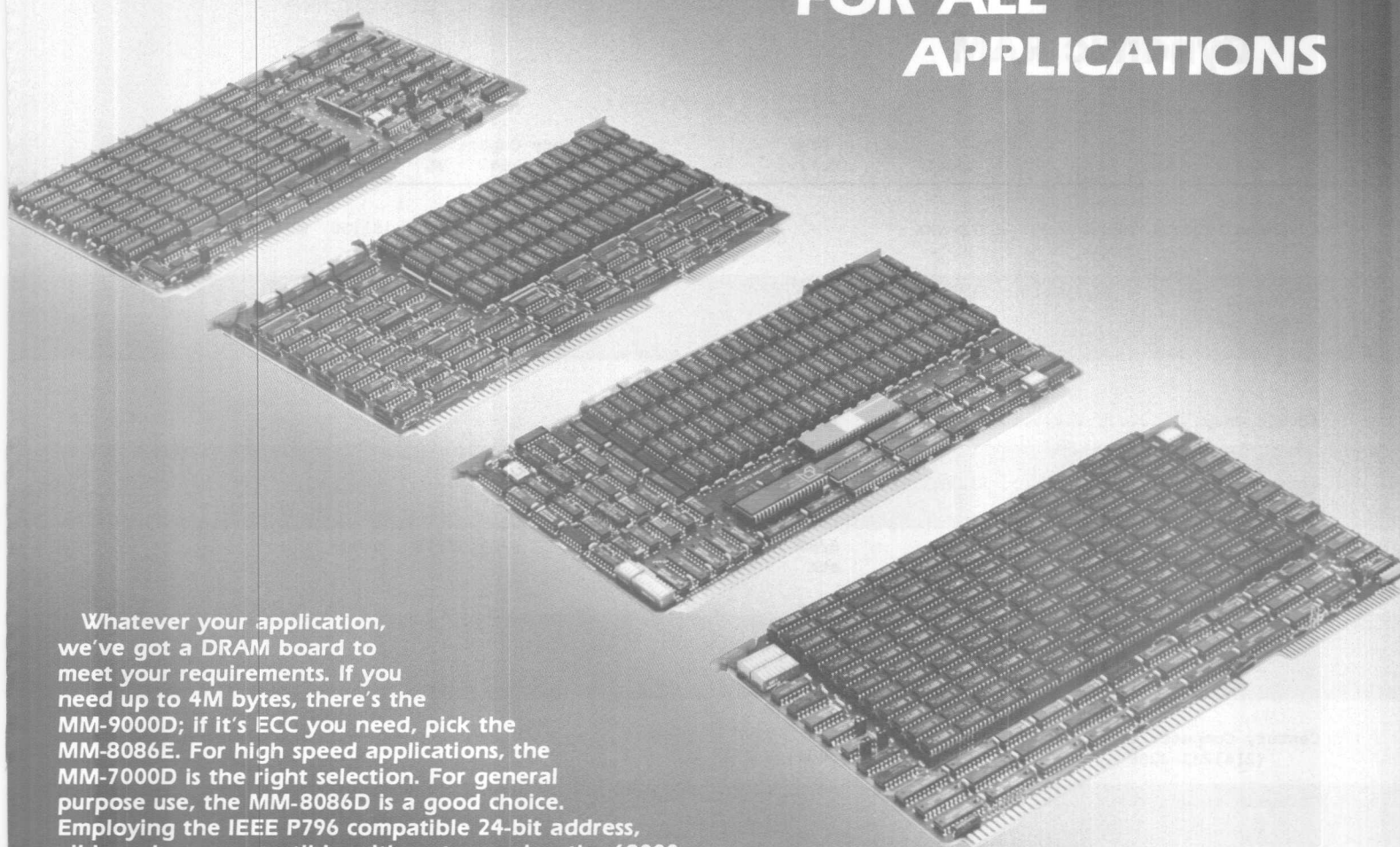
Or get on board fast by calling (800) 368-2738 today. Your bus ought to be going our way.

 **PLESSEY**

Multibus is a trademark of Intel  
VERSAbus is a trademark of Motorola



# MULTIBUS DRAMS FOR ALL APPLICATIONS



Whatever your application, we've got a DRAM board to meet your requirements. If you need up to 4M bytes, there's the MM-9000D; if it's ECC you need, pick the MM-8086E. For high speed applications, the MM-7000D is the right selection. For general purpose use, the MM-8086D is a good choice. Employing the IEEE P796 compatible 24-bit address, all boards are compatible with systems using the 68000, 8086, or Z8000 microprocessors. The chart below lists our Multibus\* DRAM board line.

All boards have a one-year warranty on parts and labor. Plus, the boards are all checked by memory diagnostics while being temperature-cycled and burned in.

Part No.	Capacity, Bytes	nsec Cycle/ Access	Remarks
MM-9000D	4M, 3M, 2M, 1M, 768K, 512K	240/350	High Capacity, 64K/256K DRAMs
MM-8086E	2M, 1M, 512K, 256K, 128K	300/500	ECC, 64K/256 DRAMs
MM-7000D	2M, 1M, 512K, 256K, 128K	200/325	High Speed, 64K/256K DRAMs
MM-8086D	512K, 256K, 128K, 64K	250/400	General Purpose

\*Multibus is a trademark of Intel Corp.

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Phone: (213) 998-0070

# MULTIBUS DYNAMIC RAM FOR ALL

Manufacturer	Model	DFA/ Deliv.	Memory Capacity (Kbytes)/Price									
			16	32	48	64	96	128	256	384	512	
Advanced Digital Technology ..	VLS-XXX	-	-	-	-	-	-	-	\$1150	\$1350	\$1550	\$1750
AMD .....	Am96/0000B	★8/83 stk	-	-	-	-	-	-	-	-	-	\$1950
	(408)988-7777											
	Am97/0000	7/82 stk	-	\$669	-	\$683	-	\$ 740	\$1250	-	\$1599	
Advant Corp. ....	MS7200	10/82 -	-	-	-	-	-	-	-	-	-	*
AIM Technology .....	512KB ECC	7/82 30da	-	-	-	-	-	-	-	-	-	\$2990
	(408)727-3711											
Central Data Corporation .....	B1020	6/80 stk	-	\$640	-	\$705	\$775	\$ 845	-	-	-	
	(217)359-8010											
	B1040	5/83 stk	-	-	-	-	-	\$1005	\$1170	\$1360	\$1540	
	B1027	2/83 stk						\$1270	\$1485	\$1715	\$1925	
Century Computer Corp. ....	V8012	- 30da	-	-	-	-	-	-	-	-	-	\$1800
	(214)233-3238											
Chrislin Industries .....	CI-8086+	-	-	-	-	-	-	\$ 645	\$ 695	-	\$ 895	
Comark Corporation .....	MR85-32	11/81 -	-	\$395	-	\$495	\$595	\$ 695	-	-	-	
	(617)359-8161											
	MR86-128	2/82 -	-	-	-	-	-	\$ 695	\$ 895	\$1195	\$1395	
Cyb Systems, Inc. ....	256K	9/82 -	-	-	-	-	-	-	\$1450	-	-	
	(512)458-3224											
Datacube .....	RM119-016	- -	\$630	\$599	o	\$649	-	-	-	-	-	
	(617)535-6644											
	RM117	- -	\$1200	-	-	-	-	-	-	-	-	
Densan .....	DSB-064A	- -	-	-	-	*	-	-	-	-	-	
Edge Micro Systems .....	B128K	-/82 -	-	-	-	-	-	\$ 500	-	-	-	
Frontier Technologies Corp. ..	-	★12/83	-	-	-	-	-	-	\$1595	-	\$2995	
	(414)964-8689											

# Dynamic RAM

768	1024	Access Time (ns)	Cycle Time (ns)	Parity or ECC	Data Bus/ Address (bits)	Distinguishing Features
-	-	250	440	E	8-16/24	Up to 1536Kbytes available, dynamic memory mapping.
\$2515	\$2995	200	300	P	16/24	Up to one MB of memory using 64K dynamic RAM with very low power consumption.
		200	350	P	8-16/24	Very fast memory board with low power consumption. Parity error detection. Latching error registers and power back-up capability.
-	-	-	-	E	8-16/24	IEEE 796, Intr. on single/double bit errors; error status LED's.
-	-	250	-	E	8-11/24	One-wait state access time with AIM 68000 CPU. On-board refresh circuitry, with 6 hamming coded ECC bits. Fully diagnosable. Manufacturing license avail.
-	-	330	450	P	8-16/24	Addressable 64K memory boundry, 16K deselect.
-	-	230	345	P	8-16/24	4 Layer construction. Battery back-up capabilities.
-	-	265	375	E	8-16/24	6 Layer construction. Corrects single bit errors, deletes double and multiple bit errors.
-	-	-	-	E	8-16/-	EEC rewrites single bit errors on the fly. May be populated with 256K chips to 2MB.
		270	400	P	8-16/-	Up to 2MB in a single option slot. (\$5995)
		350	-	P	8-16/24	4K Bank disable.
		350	-	P	8-16/24	16K Bank disable.
		-	-	-	-	
		350	550	-	-16/20	All versions fully socketed.
		350	-	-	-16/20	Dual ported for dual processor systems; virtual 1Mbyte memory space; optional expansion 16K, \$650.
		450	-	*	-16/-	
		270	-	P*	16/20	
		-	-	P	-	Multiple boards for expansion to 1MB. Battery back-up. Diagnostic software.

continued next page

# Dynamic RAM

Manufacturer	Model	DFA Deliv.	Memory Capacity (Kbytes)/Price								
			16	32	48	64	96	128	256	384	512
Heurikon Corporation ..... (608) 271-8700 (800) 356-9602	MLZ-EDC	-	-	-	-	-	-	\$1695	\$1995	-	\$2995
	MLZ-128-P	-	-	-	-	-	-	\$1195	\$1495	-	\$1895
Intel Corporation ..... See Sales Office Listing	064	-	-	\$695	-	\$590	-	-	-	-	-
	iSBC 028A/ 056A	-	-	-	-	-	-	\$ 742	\$1260	.0	.0
	iSBC 064A/ 012B/032A	-	-	\$500	-	\$685	-	-	-	-	\$1604
	iSBC 028C/ 056C/012C	-	-	-	-	-	-	\$1520	\$1950	-	\$2860
	iSBC 028CX/ 056CX/012CX	-	-	-	-	-	-	\$1900	\$2450	-	\$3575
Interactive Images Inc. .... (617) 938-8440	RAM	★9/83 30da	-	-	-	-	-	\$ 995	\$1055	-	\$1395
Intersil Systems ..... (408) 743-4442	MCB-512	9/81 stk	-	-	-	-	-	\$1429	\$1786	-	\$2571
	MCB-2X	★10/83	-	-	-	-	-	\$1515	\$1665	-	\$2040
Logitech, Inc. .... (415) 326-3885	PYO256	4/82 2wk	-	-	-	-	-	\$ 690	\$ 975	-	-
Matrox Electronic ..... (514) 735-1182	MEGA 1	-	-	\$650	-	\$965	-	\$1470	-	-	-
	MEGA 4	-	\$680	-	-	\$995	-	\$1365	\$1730	-	\$2100
Measurements Systems ..... (714) 633-2240	HDMC-512	★8/83	-	-	-	-	-	-	-	-	\$2385



# Dynamic RAM

768	1024	Access Time (ns)	Cycle Time (ns)	Parity or ECC	Data Bus/ Address (bits)	Distinguishing Features
-	-	-	-	E	-/-	
-	-	-	-	-	-/-	
-	-	450	-	-	8-16/20-24	
-	-	500	-	P	8-16/24	Optional: iSBC 305/306 ECC Multimodule.
-	-	330-500	-	P	8-16/24	
-	-	350	460	E	8-16/24	High performance RAM with ECC.
-	-	380	490	E	8-16/24	Multibus/iLBX bus compatible, dual port high performance RAM with ECC.
-	-	-	-	P	8-16/24	Addressable on 64K boundaries. Error status register. Byte swapping. Provision for 256K RAM chips.
-	-	460	660	E	8-16/-	Single +5V operation; compatible with iSBC 80/10, 80/20, 80/30, 80/12.
-	-	370	400	E	8-16/24	Available in 1 and 2MB versions. Addressable on any 64 boundary. Memory mapped I/O.
-	-	350	400	P*	8-16/24	Optional dynamic mapping; up to 8 memory blocks (32Kbytes) on line at the same time for 16/20/24-bit address systems.
-	-	400	-	-	8-16/-	
-	-	625	725	P	8-16/24	Memory Management.
-	-	240	440	E	-	4Kbytes of cache memory on board. Expandable to 2MB. Dual bus architecture. Error syndrome bit latching.

continued next page

# Dynamic RAM

Manufacturer	Model	DFA/ Deliv.	Memory Capacity (Kbytes)/Price									
			16	32	48	64	96	128	256	384	512	
Microbar Systems ..... (415)964-2862	DBR50-128	3/82 1wk	-	-	-	-	-	\$1455	\$1715	-	\$2275	-
Micro Industries ..... (614)895-0404	MIB016A	-	\$490	\$600	-	\$785	-	-	-	-	-	-
MicroMemory, Inc. .... (213)998-0070	MM8086D	8/81 -		\$400	-	\$425	-	\$ 625	\$ 695	-	\$ 895	-
	MM8086E	9/82 -		-	-	-	-	\$ 750	\$ 970	-	\$1295	-
	MM9000D	★8/83	-	-	-	-	-	-	-	-	\$1050	-
	MM7000D	★8/83	-	-	-	-	-	\$ 645	\$ 795	-	\$ 995	-
Monolithic Systems Corp. .... See Sales Office Listing	MSC 4805	-	-	-	-	-	-	\$1026	\$1208	\$1391	\$1573	-
	MSC 4808	★9/83	-	-	-	-	-	\$ 812	\$ 962	-	\$1260	-
Motorola ..... .....	MMS8701	-	-	-	-	-	-	\$1125	\$1465	-	-	-
	MMS8512E	-	-	-	-	-	-	\$1450	\$1790	-	\$2543	-
National Semiconductor ..... See Sales Office Listing	BLC-OXXX	-	-	-	\$425	\$560	-	\$ 700	\$1136	-	\$1219	-
	BLC-80XXX	-	\$520	-	\$609	\$800	-	-	-	-	-	-
NEC Electronics U.S.A. .... (617)655-8833	BPO300	9/81	-	-	-	-	-	\$1255	\$1695	-	-	-

# Dynamic RAM

768	1024	Access Time (ns)	Cycle Time (ns)	Parity or ECC	Data Bus/ Address (bits)	Distinguishing Features
-	-	215	440	P	8-16/24	Dual bus (IEEE 796 & high speed), high speed port may be accessed by DBC 86 or DBC 68K while a 796 cycle is in progress.
-	-	360	600	- P*	8-16/-	Dynamic RAM.
-	-	250	400	P	8-16/24	Selectable in 4K increments. Parity output selectable to any of the Bus intercepts.
-	-	300	500	E	8-16/24	Error detection and correction circuitry provides for double bit error detection and single-bit error correction. CSR/ESR registers in the I/O page for error logging and manipulation.
\$1450	\$1695	240	350	P	8-16/24	Selection on 4000 <sub>H</sub> boundaries in 16Mbyte address field parity and CSR. 2M, 3M and 4M available.
-	-	200	325	P	8-16/24	Selectable in 1000 <sub>H</sub> increments. Parity and CSR available on the board. Jumper options for use of 256KDRAM. Battery back-up option.
-	-	450	500	ECC	8-16/20	Error detection and correction (EDAC) circuitry provides for double-bit error detection and single-bit error correction.
-	-	350	500	P	8-16/24	Battery back-up. Error detection by interrupt or polling.
-	-	320	420	P	8-16/24	
-	-	430	660	-	8-16/16	48 and 64Kbyte version have 400ns Access, 500ns Cycle. 4Kbyte has parity and 64K ECC.
-	-	450	650	ECC	8-16/16-20	Error detection and correction is a delete option; 128K version is available with and without EC. Dynamic memory mapping; allows 8-bit system to access 16Mbyte.

continued next page

# Dynamic RAM

Manufacturer	Model	DFA/ Deliv.	Memory Capacity (Kbytes)/Price									
			16	32	48	64	96	128	256	384	512	
One/D Corporation .....	SRM XX	4/82 stk	-	\$440	-	\$ 510	-	\$ 650	\$ 930	-	\$1490	
Plessey Microsystems .....	PSM 512A	7/81 stk	-	-	-	-	-	\$ 769	\$1016	-	\$1595	
(301) 279-2892												
(800) 368-2738	PSM 512P	6/82 stk	-	-	-	-	-	\$ 565	\$ 775	-	\$1200	
Questar Computer Sys. ....	SBM-100	2/82 -	-	-	-	\$ 528	-	\$ 625	\$ 848	-	\$1095	
(408) 286-2866												
	SBM-110	2/83 -	-	-	-	\$ 584	\$ 688	-	\$ 933	-	\$1205	
	SBM-160	2/83 -	-	-	-	-	-	\$ 971	\$1103	-	\$1680	
Relms .....	rMEM64K-BE	-	-	\$518	-	\$ 640	-	-	-	-	-	
	rMEM256K-BE	-	-	-	-	\$1095	-	\$1813	\$1950	-	-	
	rMEM64K-D	-	\$466	\$518	\$576	\$640	-	-	-	-	-	
Texas Instruments .....	TMM40010A	2/82	-	-	-	-	-	\$ 828	\$1054	-	\$1500	
	TMM40020	1/83	-	-	-	-	-	\$ 841	\$ 995	-	\$1333	
Zendex Corporation .....	ZX-012	1/82 stk	-	-	-	-	-	-	*	-	\$3595	
(415) 828-3000												
	ZX-028B	5/80 stk	-	-	-	-	-	\$1050	-	-	-	
Zitel Corporation .....	ZBC-0512	10/82	-	-	-	-	-	*	*	*	*	
(213) 664-3165												



# NON-VOLATILE MEMORY FOR THE MULTIBUS

768	1024	Access Time (ns)	Cycle Time (ns)	Parity or ECC	Data Bus/ Address (bits)	Distinguishing Features
		480	560	P	8-16/20	MMU is software compatible with 64KB limited systems, allows memory expansion to 1MB with no system modifications, provides upward software compatibility to CP/M 3.0.
		350	450	EEC	8-16/20-24	Can be set to 4K boundaries, logging of errors via I/O.
		250	350	P	8-16/20-24	I/O control, byte locations of Parity error and interrupt.
		330	430	p*	-/-	
		240	290	ECC	-/-	Battery back-up standard.
		290	-	EDC	-/24	Battery back-up.
		250	330	-	8-16/-	
		210	300	P	8-16/-	
		250	330	-	8-16/20	
		325	700	E	-/24-20	Single bit error correction, double bit error detection. Switch selectable address bus.
		195	300	P	-/20-24	Parity generation optional switch selectable address bus.
		300	500	E	8-16/20	Byte swapping; two board set; +5V only.
		414	489	-	8-16/20	Byte swapping for compatibility with 8086 systems.
		300	400	*	8-16/16	Parity is optional. Optional battery back-up.

# NON-VOLATILE MEMORY FOR THE MULTIBUS

64K Battery-backed  
CMOS RAM:  
\$680 (1's)  
\$520 (100's)

64K EEPROM,  
Static/  
CMOS RAM or  
PROM/EPROM:  
\$275 (1's)  
\$205 (100's)  
unpopulated

256K PROM/  
EPROM:  
\$275 (1's)  
\$205 (100's)  
unpopulated

64K PROM/  
EPROM:  
\$245 (1's)  
\$185 (100's)  
unpopulated

Electronic Solutions has non-volatile system memory cards in sizes and prices just right for your system. Take a look at this sample of memory cards—all designed specifically for the Multibus:

**CMOS RAM:** Make use of low-power CMOS RAM with the RAM-C series. Choose from 8K up to 64K bytes with 170 hrs. of NiCd battery backup on board. All have 8/16 bit data paths and 20 bit addressing. The unpopulated board price is only \$295 (singles) or \$225 in 100's.

**EEPROM:** There's a new application idea every day for these versatile components. Program development or downloading, configuration tables and security access logs are just a few. For the 5V X2816A type, Electronic Solutions RAM-S series has a 64K board on which you can intermix EEPROM, CMOS/static RAM and EPROM. For other types, the EEPROM-32 has on-board  $V_{pp}$  for up to 32K of EEPROM or 2716 EPROM.

**PROM/EPROM** (Use the new 27128's for up to 256K on the PROM-64/256, with 24-bit (16Mb) addressing. It holds either 28-pin or 24-pin chips. Or choose from 3 other models with less capacity.

For all the details in a hurry,  
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**TOLL FREE 800-854-7086**  
In California 800-772-7086

 **Electronic  
Solutions**

9255 Chesapeake Drive  
San Diego, CA 92123

# Static RAM

---

AMTELCO  
Central Data Corporation  
Cormark Corporation  
CYB Systems, Inc.  
Datacube, Inc.  
Densan Co., Ltd.  
Diversified Technology, Inc.  
Electronic Solutions  
EMM/Sesco  
Heurikon Corporation  
Intel Corporation  
Intersil Systems  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Plessy Microsystems  
Relms  
Stynetic Systems, Inc.  
Thomas Engineering Co.

# Static RAM

Manufacturer	Model	DFA	Deliv.	4	Capabilities (Kbytes)/Price							
					8	16	32	48	64	128	256	
AMTEL CO ..... (608)221-3856	210A031	8/82	stk	-	\$426	-	\$475	\$540	\$670	\$1595	\$2785	
Central Data Corp. .... (217)359-8010	B1035/32- 128K	4/83	stk	-	-	-	\$800	-	-	\$2010	-	
Comark Corporation ..... (617)359-8161	MR 80-8C	1/79	-	-	\$495	\$795	\$1295	-	-	-	-	
Cyb Systems, Inc. .... (512)458-3224	16KE	9/82	-	-	-	\$480	-	-	-	-	-	
Datacube, Inc. ....	CM-118	80	stk	-	-	-	\$810	-	-	-	-	
	CM-118SL	80	stk	-	-	\$760	-	-	-	-	-	
Densan .....	DSB-016	-	-	-	-	*	-	-	-	-	-	
Diversified Technology ..... (601)856-4121	CBC 256	8/82	stk	-	-	\$479	\$619		\$884	\$1205	\$1989	
Electronic Solutions ..... (714)292-0242 (800)854-7086	RAM-4C	-	stk	\$370	\$400	\$450	\$550	-	\$680	-	-	
	RAM-16S	-	stk	\$325	\$345	\$390	\$475	-	-	-	-	
	RAM-4	-	stk	\$325	\$345	-	-	-	-	-	-	



Access Time (ns)	Cycle Time (ns)	Parity or ECC	Data Bus/ Address (bits)	Distinguishing Features
100	-	-	16-24	Up to 256K of CMOS RAM or up to 32 byte-wide memory elements (ROMs, PROMs, RAMs) in 8/16-bit systems. Battery back-up.
295	295	P	8-16/24	Battery back-up and real-time clock standard. Low power CMOS static RAMs. 4 independently addressable banks.
450	550	P	8-16/20	CMOS; optional battery back-up, \$45.
-	-	-	-	
250	-	-	8-16/16-20	Includes 8Kbyte ROM/EPROM sockets.
450	-	-	8-16/16-20	
350	-	-	-/-	
300	-	-	8-16/20/24	Complete CMOS design for low power; 250mW power dissipation. On-board NiCad battery 3000 hrs. data retention.
300	300	-	8-16/16-20	CMOS with battery back-up, data retention minimum 170 hours; 3 year limited warranty; 4K memory select. 168 hours burn-in.
300	-	-	8-16/20	
400	-	-	8/16	Optional battery back-up.

continued next page

# Static RAM

Manufacturer	Model	DFA	Deliv.	Capacities (Kbytes)/Price							
				4	8	16	32	48	64	128	
EMM/Sesco .....	SECS 80/116	-	-	-	-	\$1800	-	-	-	-	
Heurikon Corporation .....	MLZ-8/16	-	stk	-	-	\$595	\$895	-	-	-	
(608) 271-8700											
Intel Corporation .....	iSBC 301	-	-	\$325	-	-	-	-	-	-	
See Sales Office Listing											
	iSBC 302	-	-	-	\$450	-	-	-	-	-	
Intersil Systems .....	MCB-364	11/82	-	-	-	-	-	-	o	-	
(408) 743-4599											
National Semiconductor .....	BLC-8302	-	-	-	\$400	-	-	-	-	-	
NEC Electronics U.S.A. ....	BP0200	6/80	stk	-	\$1145	\$1300	\$1375	-	-	-	
(617) 655-8833											
	BP0220	9/80	stk	-	\$1075	\$1235	-	-	-	-	
Plessey Microsystems .....	PSM 6463-1	3/81	stk	-	-	\$695	\$900	-	\$1375	-	
(301) 279-2892											
(800) 368-2738											
Relms .....	rMEM 16K-BES	-	-	-	-	\$545	-	-	-	-	
Stynetic Systems, Inc. ....	NVR 8010	1/82	stk	-	\$695	-	-	-	-	-	
Thomas Engineering Co. ....	MZ-MMBsp	6/82	-	-	-	-	\$645	-	-	-	

# MULTIBUS<sup>®</sup> LICENSING

Severely, we have asked Intel to explain why

Access Time (ns)	Cycle Time (ns)	Parity or ECC	Data Bus/Address (bits)	Distinguishing Features
385	-	-	-/-	MIL-Spec.
-	-	-	-/-	Sockets for 4K or 8K EPROM.
150	-	-	-/-	Multimodule, compatible hosts; iSBC 80/24, 88/40.
70	-	-	-/-	Multimodule, compatible hosts; iSBC 86/05, 88/25.
270	350	-	8-16/24	CMOS static RAM; NiCad battery back-up retains data up to 14 days; jumper selectable starting address at any 4K boundary.
70	-	-	-/-	BLX module, compatible with BLC-86/05.
450	600	-	8-16/16-20	On-board battery back-up; low power CMOS. Provision for ACLO line input to disable RAM.
450	600	-	8-16/16-20	On-board battery back-up; low power CMOS; sockets for 32 Kbytes PROM; provision for ACLO line input to disable RAM.
200	200	-	8-16/16-20	CMOS RAM on-board NiCad battery back-up; data retention of 350 hours.
150	260	-	8-16/20	
-	-	-	8-16/20	Includes 1K high speed non-volatile RAM without batteries.
-	-	-	-/-	

Intel BUS Marketing  
Intel Corporation  
11000 N. Shoreline Blvd.  
Santa Clara, CA 95051

Intel Corporation  
Intel Corporation  
11000 N. Shoreline Blvd.  
Santa Clara, CA 95051

## MULTIBUS® LICENSING

Dear MULTIBUS Manufacturer:

Several of you have asked Intel to explain our position on the patenting and licensing of MULTIBUS. So we thought that we would take the opportunity of the introduction of MULTIBUS II to do just that.

In the early days of MULTIBUS, when there were only 8-bit processors, there were no patents or restrictions on the bus. With the advent of some rather novel byte-swap techniques to do more advanced 16-bit operations and still maintain compatibility with the 8-bit world, we found we had in fact invented a rather novel approach, and were advised to apply for a patent on it.

We applied for the patent in 1978. When the patent was approved in 1982, we had the option of charging a royalty on every board which other manufacturers made, charging a one-time license fee or letting the patent go free with the possibility of losing our right to it. The former obviously could have limited the industry's use of it, and the latter did not adequately reward our engineers who had invented it, so we chose the one-time license fee. We set it low enough to be easily affordable by any company serious about the business, yet high enough to be both meaningful and to partially recover some of our legal fees and development costs. We chose \$500.00.

Now MULTIBUS II is being introduced. You can read about it elsewhere in this Guide. It will take the world of MULTIBUS users from 16-bits to 32-bits just as the patent on MULTIBUS I took us all from 8-bits to 16-bits. There are several techniques under a single patent which have been applied for. If the patent is granted, it is our intention to license the patent again on a one-time charge basis. We expect the license fee to be slightly higher for MULTIBUS II; perhaps around \$1,000.00.

You are not liable for the license fee until such a time as we have been awarded a patent, and you have manufactured a MULTIBUS II product. So until that time, don't worry about it.

If you have any further questions about licensing, contact either;

Tom Dunlap  
Legal Department  
Intel Corporation  
Santa Clara, CA

Rob Hughes  
MULTIBUS Marketing  
Intel Corporation  
Hillsboro, OR

**intel**® delivers  
solutions



# RAM/ROM

AMTELCO  
Central Data Corporation  
Datacube, Inc.  
Densan Co., Ltd.  
Electronic Solutions  
EMM/Sesco  
ETI Micro  
Megalogic Corporation  
Monolithic Systems Corp.  
NEC Electronics U.S.A.  
Sibthorp Systems, Inc.

# RAM/ROM

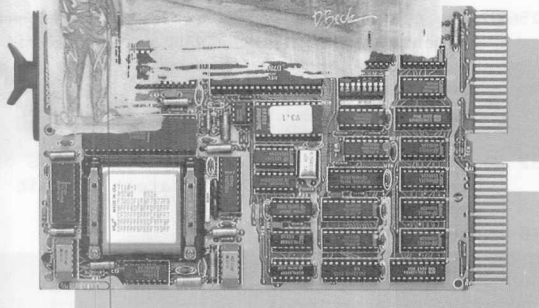
Manufacturer	Model	Price	DFA	Deliv.
AMTEL CO ..... (608) 221-3856	210A031	\$410 \$2785*	3/83	stk
Central Data Corp. .... (217) 359-8010	B1035	\$635	4/83	stk
Datacube, Inc. .... (617) 535-6644	CM-126A	\$595	81	stk
Densan .....	DSB-416	\$-	-	-
Electronic Solutions ..... (714) 292-0242 (800) 854-7086	RAM/PROM 4C	\$390	-	stk
	RAM/PROM 4S	\$325	-	stk
EMM/Sesco .....	SECS 80/164	\$-	-	-
ETI Micro ..... (415) 829-6600	8104	\$385	3/81	stk
Megalogic Corporation ..... (513) 833-5222	PAM-1/ES	\$295	-	stk
Monolithic Systems ..... (303) 770-7400	MSC 4602-04	\$454	-	-
	MSC 4802-16	\$563	-	-
NEC Electronics U.S.A. .... (617) 655-8833	BPO220	\$1075	9/80	stk
Sibthorp Systems, Inc. .... (606) 525-1300	BSM-102	\$495	3/81	stk

Max. RAM Cap./Supplied (Kbytes)	Max. ROM Cap./Supplied (Kbytes)	Data Bus (bits)	Address (bits)	+5V Only	Distinguishing Features
256/-	256/-	8-16	16-24		256Kbytes of CMOS RAM or up to 32 byte-wide memory elements (ROMS, PROMS, RAMS) in 8/16-bit systems. Battery back-up.
128/-	512/-	8-16	24	-	Real-time clock, NiCad on lithium batteries for back-up of CMOS RAM.
Any combination to .5 Mbyte		8-16	20	-	32 sockets for 15 generic memory types, MOS or bi-polar, from 4K to the latest 128Kbit products.
8/-	8/-	-	-	-	16 sockets 2708 or 2716.
28/4	28/-	8-16	20		CMOS RAM/PROM; includes 170 hour on-board battery back-up. Wide range of capacities available.
28/4	28/-	8-16	20		Static RAM. Wide range of capacities available.
32/-	64/-	-	-		MIL-Spec.
32/-	64/-	8	20		16, 28-pin sockets, accomodates any Jedec standard memory; +5V only; selective battery back-up at each socket.
8/-	8/-	-	-		-5 volts for 2708 PROMS on-board
16/- 64*	32/-	8-16	20		
128/- 256*	32/-	8-16	20		
16/-	32/-	8-16	16-20		On-board battery back-up; Low power CMOS; sockets for 32Kbytes PROM; provision for ACLO line input to disable RAM.
64/-	128/-	8-16	16-20		Bank switchable in 16K or 32K blocks of like memory banks may be overlapped, RAM's battery backable, 32 sockets, up to 128Kbytes.

*Solid-state magnetic-bubble memory from Bubbl-tec*

## Mass storage that works where disks don't

**QSB-11:** For Q-bus systems.  
Emulates standard  
DEC® floppies



Once upon a time, computing was done only in nice, clean places, and a spinning disk could handle the mass storage job quite nicely.

But, no more. Now computers are down on the factory floor, up in airplanes and out in the field. For this new world of applications, you need *solid-state* mass storage, like Bubbl-tec magnetic-bubble memory systems.

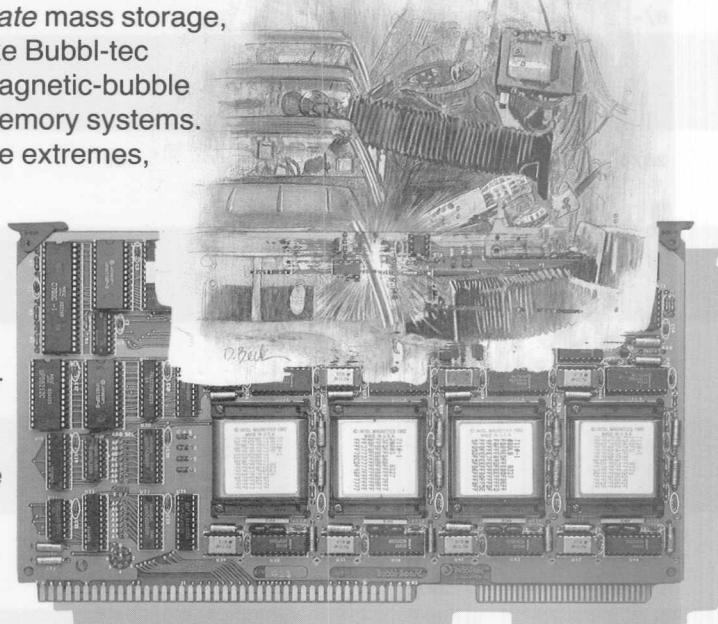
They can stand up to the dirt, dust, temperature extremes, shock and vibration that knock out disks.

Bubbl-tec systems provide battery-free, non-volatile mass storage from 32 Kbytes to 8 Mbytes, with extremely fast access to every data block. And our systems plug directly into your microcomputer bus – no need for another chassis or power supply.

Since 1979, we've been shipping solid-state mass storage systems for every popular microcomputer bus,

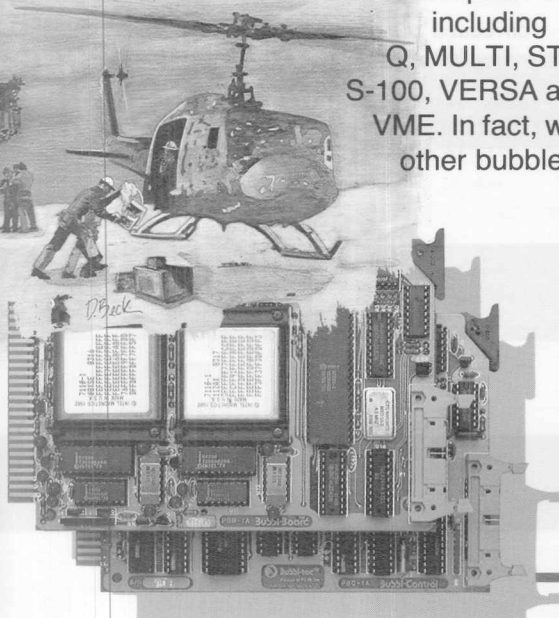
including  
Q, MULTI, STD,  
S-100, VERSA and  
VME. In fact, we have more systems in the field than any

other bubble-system supplier.



**MBI-1:** Up to 8M bytes  
for MULTIBUS® micros

So, if you don't want to contend with disk deterioration, head crashes, and mechanical breakdowns, contact Bubbl-tec. Our mass storage solutions have a solid foundation.



**PBC-1 & PBB-1:** For STD-Bus systems

DEC is a registered trademark of Digital Equipment Corp.  
MULTIBUS is a registered trademark of Intel Corp.

 **Bubbl-tec**™  
Division of PC/M Inc.

6800 Sierra Court  
Dublin, California 94568  
Telephone: 415/829-8700  
TWX/Telex: 910/389-6890



# Nonvolatile Memory

Ampex Corporation  
 Bubbl-tec  
 Central Data Corporation  
 Diversified Technology, Inc.  
 EMM/Sesco  
 General Digital Corp.  
 Intel Corporation  
 Intersil Corporation  
 Micro Memory, Inc.  
 NEC Electronics U.S.A.  
 Plessey Microsystems  
 Schneider Instruments  
 Stynetic Systems

HOW  
 AVAILABLE  
 21889  
 QUANTITY  
 ONE

Compare these key features:

BUBBLE MEMORY BOARD INTEL 180C 25A - 2A		CMOS STATIC RAM BOARD DIT C8C 255	
Operating Temperature	0°-55°C	Operating Temperature	0°-70°C
Core Bits Reduced	2	Core Bits Reduced	300 nanoseconds typ.
Cycle Time	48 milliseconds avg.	Cycle Time	100 nA (max)
Operating Currents	30A 1A (max)	Operating Currents	2V
Operating Voltages	5V 12V	Operating Voltages	256K bytes
Memory Size	Multibus	Memory Size	Multibus

## ADDITIONAL FEATURES OF DIT'S C8C 255 INCLUDE:

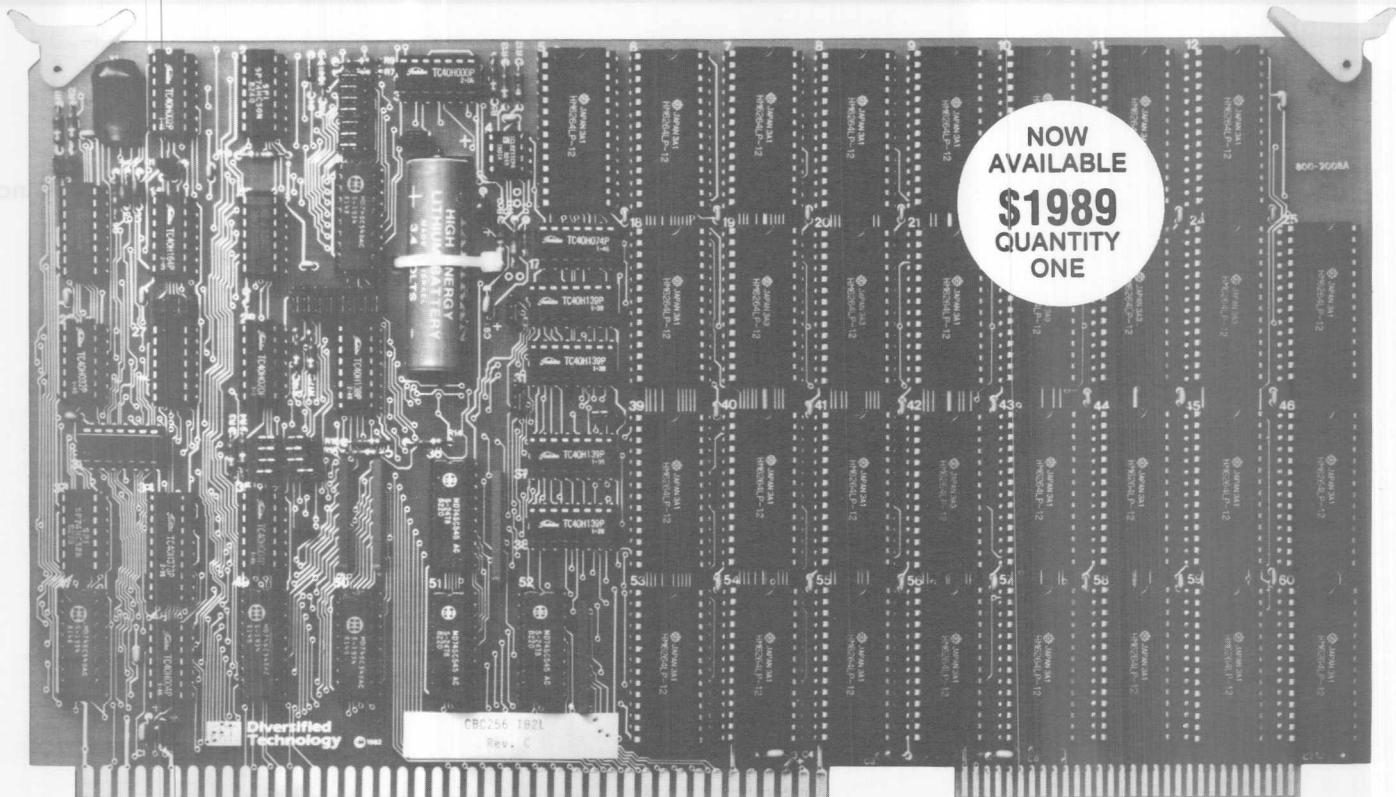
- All - CMOS technology
- Flexible addressing
- 16 bit with paging
- or 24 bit contiguous
- 8 or 16 bit data words
- 3-year data retention time
- 256K 128K 64K 48K 32K and 16K byte versions

For more information regarding the C8C 255K CMOS Ram board or any of our other CMOS Multibus boards, call or write Bill Long, C8C Product Manager at (607) 854-4731.

Diversified  
 Technology

# 256K CMOS RAM

Better Performance than Bubble - at a Comparable Price



## Compare these Key Features:

	INTEL iSBC 254 - 2A BUBBLE MEMORY BOARD	DTI CBC 256 CMOS STATIC RAM BOARD
Bus	Multibus	Multibus
Memory Size	256K bytes	256K bytes
Operating Voltages	5V, 12V	5V
Operating Currents	3.0A, 1.4A (max.)	100mA (max.)
Cycle Time	48 milliseconds avg.	300 nanoseconds typ.
Card Slots Required	2	1
Operating Temperature	0°-55°C	0°-70°C

### ADDITIONAL FEATURES OF DTI'S CBC 256 INCLUDE:

- All - CMOS technology.
- Flexible addressing:  
16 bit with paging  
or 24 bit contiguous.
- 8 or 16 bit data words.
- 3-year data retention time.  
256K, 128K, 64K, 48K, 32K  
and 16K byte versions.

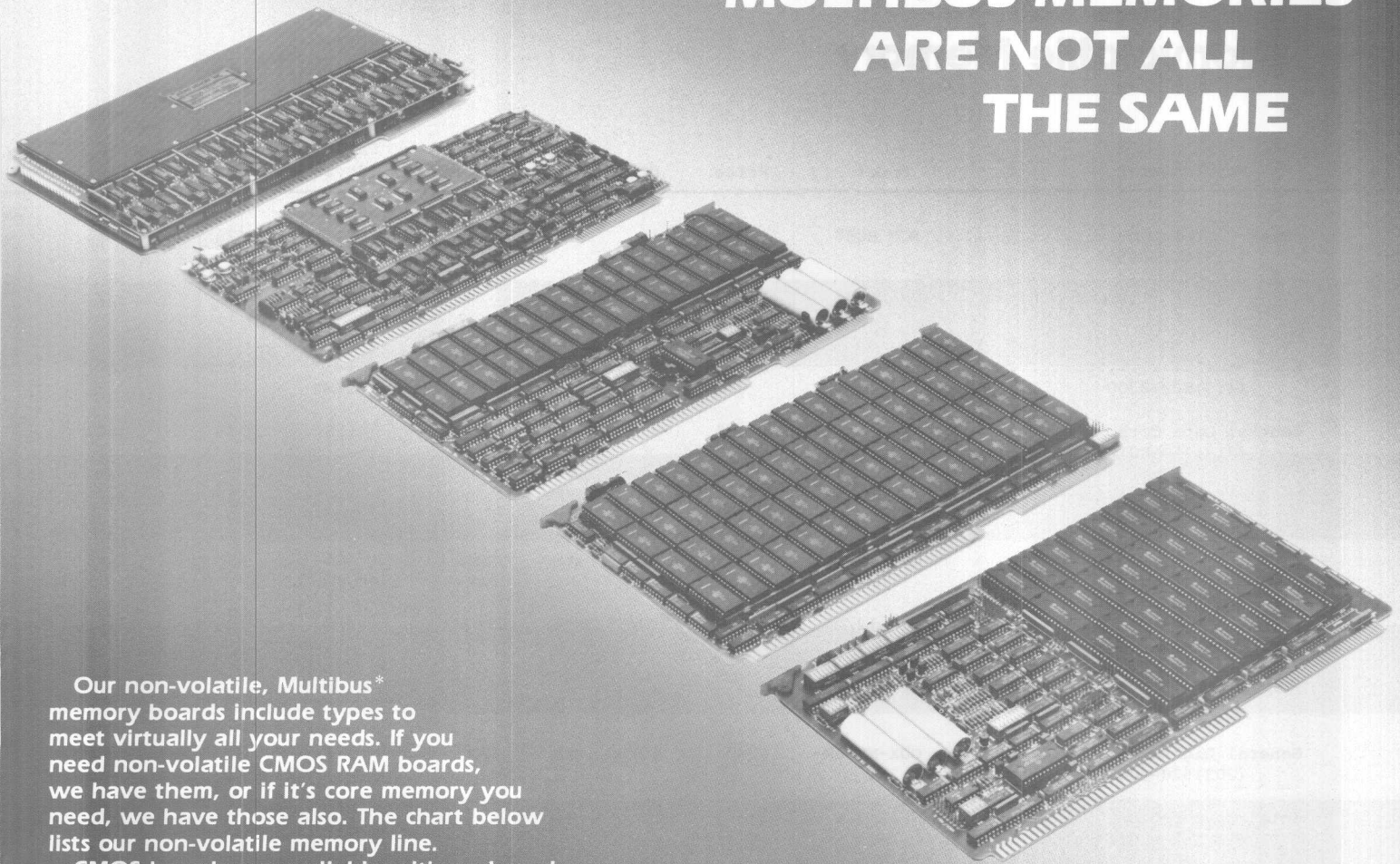
For more information regarding the CBC 256K CMOS Ram board, or any of our other all-CMOS Multibus boards, call or write Bill Long, CBC Product Manager at (601) 856-4121.

**Diversified  
Technology**  
An Ergon Co.

Multibus and iSBC are trademarks of Intel Corp. Above specifications taken from manufacturers current published data.

P. O. Box 748, Ridgeland, MS 39157  
Telex 585326.

# NON-VOLATILE MULTIBUS MEMORIES ARE NOT ALL THE SAME



Our non-volatile, Multibus\* memory boards include types to meet virtually all your needs. If you need non-volatile CMOS RAM boards, we have them, or if it's core memory you need, we have those also. The chart below lists our non-volatile memory line.

CMOS boards are available with on-board rechargeable or non-rechargeable batteries. Redundant, fused batteries provide enhanced reliability.

All boards have a one-year warranty on parts and labor. Plus, the boards are all checked by memory diagnostics while being temperature-cycled and burned in.

Part No.	Capacity, Bytes	nsec Cycle/ Access	Remarks	Data Rentention Lithium/NICAD
MM-8500C	256K, 128K, 64K	200/200	CMOS, Calendar/Clock	5 Years/4 Weeks
MM-8000C	128K, 64K	250/250	CMOS	—/2 Weeks (128K)
MM-8086C	64K, 32K, 16K	220/220	CMOS, Calendar/Clock	2 Years/3 Weeks
MM-8086/16	16K	280/800	Core, Data Protect	Infinite
MM-8086	32K	375/1200	Core, Data Protect	Infinite

\*Multibus is a trademark of Intel Corp.

**FIRST IN MICRO MEMORIES**

**micro  
memory  
inc**

9436 Irondale Ave. • Chatsworth, CA 91311

Phone: (213) 998-0070



# Nonvolatile Memory

Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Kbytes)	Access Time (ns)	Data Retention
Ampex Corporation ..... (213)640-0150	MCM 8086	\$2030	-	30da	Core	32 64*	425	inf.
	MCM 8080	\$1380	-	30da	Core	16	325	inf.
Bubbl-Tec ..... (415)829-8700	MBI-1	\$1729	8/82	-	Bubble	128 8M*	41msec	inf.
Central Data Corp. .... (217)359-8010	B1035	\$ 635	4/83	stk	E <sup>2</sup> PROM	128	325	inf.
Diversified Technology ..... (601)856-4121	CBC 256	\$1989	3/83	stk	CMOS RAM	256 128*	150	3yr.
	CBC 064	\$ 884	7/82	stk	CMOS RAM	64 48,32,16*	250	7yr.
	CBC 12/24	\$3978	★10/83	stk	CMOS RAM	512 256,128*	300	3yr.
EMM/Sesco ..... (213)640-0150	SECS 80/264	\$-	mid- 82	-	Core	64	650	-
General Digital ..... (203)528-9041	GDX-NVRAM- 256	\$240	10/82	stk	RAM/	1	300	-
Intel Corporation ..... See Sales Office Listing	iSBC 254 1A	\$1875	-	-	Bubble	128 512*	48msec	-
	iSBX 251	\$ 895	-	-	Bubble	128	48msec	-
	iSBX 251C	\$ 695	-	-	Bubble	128	48msec	-



# Nonvolatile Memory

Address Capability (bytes)	Data Bus (bits)	Address (bits)	Distinguishing Features
1M	16	16	64Kbyte/module addressing; random access read/write memory; infinite data retention-without power.
64K	8	16	Data-save prevents loss of data during power up to down. Fully compatible with SBC 80/MDS 800 systems.
8M	-	-	Complete non-volatile storage system. Includes intelligent controller providing high-level command set, making it easy to write software drivers. Built-in self-test capability. CP/M compatible (BIOS provided).
128	8/16	24	Any 5V only E <sup>2</sup> PROM works, battery back-up and real-time clock standard.
1M	8-16	16-20	Complete CMOS design; 250mW of power dissipation. On-board lithium battery. Optional 128Kbyte version.
1M	8-16	16-20	Complete CMOS design; 250mW of power dissipation. On-board lithium battery. Optional 48K, 32K and 16K versions.
16M	8-16	20-24	Complete CMOS design; 250mW of power dissipation. On-board lithium battery. Optional 256K and 128K versions.
1M	-	-	MIL-Spec core memory.
256	8	Register	Expansion module for parameter/data storage during power-down. Requires no battery. Save system status or user-changeable parameters. 256bytes.
1M	8	20	Storage up to 1Mbyte; ECC; Error logging and display; Field expandable memory; optional 256K, 512K.
-	8	-	Multimodule expansion board; storage up to 128Kbytes; automatic error detection and correction; temp. range: 0 to 6°C.
-	8	-	Multimodule expansion board; operating temp. range: 10 to 40°C.

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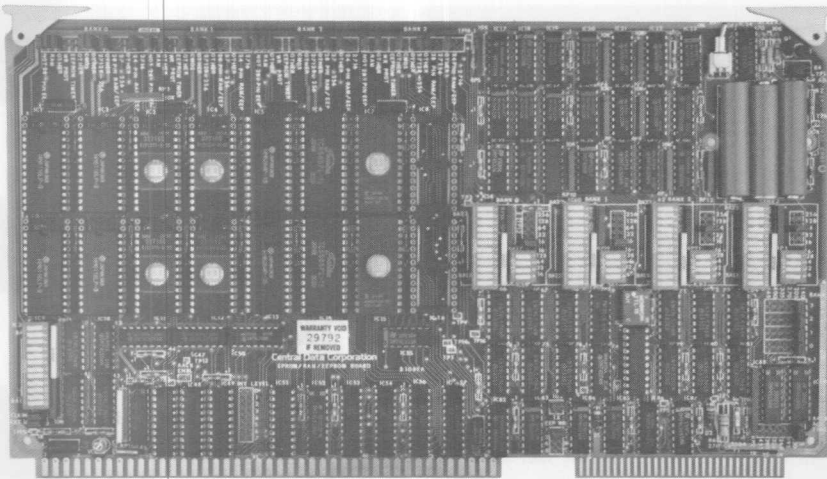
# Nonvolatile Memory

Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Kbytes)	Access Time (ns)	Data Retention
Intersil Systems ..... (408) 743-4442	MCB-332	\$ 934	5/80	stk	CMOS RAM	32 64*	390	21da
MicroMemory, Inc. .... (213) 998-0070	MM 8086CN	\$ 695	5/82	-	CMOS RAM	16	280	inf.
	MM 8086	\$1275	12/79	-	Core	32	375	inf.
	MM 8080B	\$ 790	1/79	-	Core	8	325	inf.
	MM 8500CN	\$1175	7/82	-	CMOS RAM	128 (64,256)*	250	5yr.
	MM 8500CC	\$ 849	5/82	-	CMOS RAM	64 (128,256)*	220	4wk.
	MM 8000CC	\$ 675	5/82	-	CMOS RAM	64 (32,128)*	220	2wk.
	MM 8086CC	\$ 695	5/82	-	CMOS RAM	16 (32,64)*	220	3wk.
NEC Electronics U.S.A. .... (617) 655-8833	BPO200	\$1145	6/80	stk	CMOS	16	450	7da.
	BPO220	\$1075	9/80	stk	CMOS	32	450	7da.
Plessey Microsystems ..... (301) 279-2892 (800) 368-2738	PSM 6463/00	\$1375	3/82	stk	CMOS RAM	64	200	8yr.
Schneider Instruments ..... (513) 561-6803	E4K	\$ 575	6/79	stk	EAROM	4	650	10yr.
Stynetic Systems ..... (513) 561-6803	NVR8010	\$ 695	10/81	-	E <sup>2</sup> PROM	8	-	inf.

Address Capability (bytes)	Data Bus (bits)	Address (bits)	Distinguishing Features
1M 16M*	8-16	20 24*	Utilizes ultra low power 4K CMOS static RAM's; optional 2, 4, 8, 16K versions.
16M	8-16	20	On-board redundant lithium batteries. Real-time clock/calendar. Battery status register.
1M	16	20	Infinite data retention without battery back-up.
64K	8	14	8Kbytes core and 16Kbytes EROM.
16M	8-16	24	On-board redundant NiCad Batteries, rechargeable. Battery Status Line allows computer-monitored battery condition.
16M	8-16	24	On-board redundant NiCad Batteries, rechargeable, also included is a Real-Time Calendar/Clock. Uses 8K x 8 CMOS RAM.
16M	8-16	24	On-board redundant NiCad Batteries, rechargeable. Battery Status Line allows computer-monitored battery condition.
16M	8-16	24	On-board redundant NiCad batteries rechargeable. Real-Time Clock/Calendar.
1M	8-16	20	On-board battery back-up; provision for ACLO line input to disable RAM.
1M	8-16	20	On-board battery back-up; provision for ACLO line input to disable RAM; sockets for 32Kbytes PROM.
1M	8-16	16-20	On-board Lithium Primary Cell back-up; data retention 2 years minimum, 8 years typical, 25 years maximum.
4K	-	-	Non-volatile "read mostly" memory board; optional 1K, 2K, 3K.
8K	8-16	16-20	Full-speed non-volatile NVRAM without batteries, no-wait states.

67

# The Thinking Man's Memory Board



## The Multibus\* EPROM/RAM/EEPROM Board with Real Time Clock/Calendar from Central Data.

**Think flexibility.** This new board brings the user the utmost in system flexibility. Four independent sections are each capable of accepting four EPROMs, RAMs or EEPROMs and the board can operate in either the 8- or 16-bit mode.

**Think reliability.** Reliability is built in through our extensive use of high-reliability swiss-screw machined sockets and our tough Vacrel\* board coating. Vacrel, a dry film solder mask, completely encapsulates all traces with a durable polymer plastic for the utmost in protection.

**Think capacity.** The board decodes the full 24-bit address bus, allowing a system-wide address space of 16 megabytes. It addresses up to 512K of EPROM, 128K of CMOS static RAM, or 32K of EEPROM—or a combination of all three.

**Think precision.** A real time clock/calendar with either lithium or NICAD battery backup is standard.

**Think quiet.** Noise immunity is enhanced by the board's multilayered construction, incorporating power and ground into the internal layers.

**Think speed.** The access time of each bank is strap selectable from 140ns to 465ns, independent of the other banks.

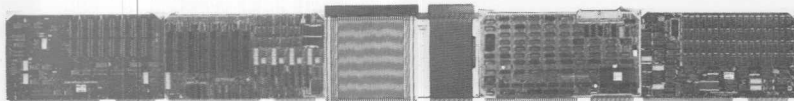
You'll find these quality features and more on the new EPROM/RAM/EEPROM Board from Central Data Corporation. Our commitment to performance and reliability is the reason more and more successful OEMs are depending on Central Data as their complete Multibus source. Make Central Data your choice—call or write today for more information on our full line of Multibus boards.

OEM quantities and pricing are available on this new board and on Central Data's full line of Multibus boards.

## Central Data

**Central Data Corporation**  
1602 Newton Drive  
Champaign, IL 61821-1098  
(217) 359-8010  
TWX 910-245-0787

Quality from the inside out in a full line.



Your  
Complete  
Multibus\*  
Source

\*Multibus is a trademark of the Intel Corporation.  
\*\*Vacrel is a trademark of the DuPont Corporation.



# (EP) ROM

Central Data Corporation  
Datacube, Inc.  
Electronic Solutions  
EMM/Sesco  
Intel Corporation  
National Semiconductor  
One/D Corporation  
Sibthorp Systems  
TSD Display

# (EP) ROM

Manufacturer	Model	Price	DFA	Deliv.	Capacity (Kbytes)	Access Time (ns)	Data Bus (bits)	Address (bits)
Central Data Corporation ..... (217) 359-8010	B1014	\$245	2/80	stk	128	100+	8/16	24
	B1035	\$635	4/83	stk	512	100+	8/16	24
Datacube, Inc. .... (617) 535-6644	PM-116	\$265	80	stk	128	select	8/16	16 20*
Electronic Solutions ..... (714) 292-0242 (800) 854-7086	PROM-32/64	\$245	-	stk	64	21.5+	8/16	20
	EEPROM-32	\$495	-	stk	32	94	8/16	20
	PROM-16/32	\$195	-	stk	32	475	8/16	20
	PROM-64/256	\$275	-	stk	256	30	8/16	24
EMM/Sesco .....	SECS 80/132	\$3600	-	-	32	650	-	-
Intel Corporation ..... See Sales Office Listing	iSBC 340	\$140	-	-	16	select	-	-
	iSBC 341	\$150	-	-	64	select	-	-
	iSBC 428	\$695	5/83	-	-	select	8/16	24
	iSBC 464	\$570	-	-	64	select	8/16	20
National Semiconductor ..... See Sales Office Listing	BLC-416	\$343	-	stk	16 32*	450	8/16	16
	BLC-464	\$570	-	stk	128	select	8/16	24
One/D Corporation .....	SPM512	\$340	4/82	stk	512	select	8/16	20
Sibthorp Systems ..... (606) 525-1300	MB-100-PROM	\$495	5/80	stk	128	175	8	16
TSD Display ..... (516) 589-6800	M60155	\$525	4/82	stk	256	select	8/16	24

Compatible Devices  
 2708 2758 2716 2732 2764 2532 Distinguishing Features

-	o	o	o	o	-	Two banks address independently.
-	-	o	o	o	-	Also uses 27128 and 27256, Realtime clock and battery back-up standard.
o	-	o	o	-	o	On-board -5 volt regulator.
-	-	o	o	-	o	Base address on a 4K boundary, 3 year warranty.
-	-	o	-	-	-	Also accepts 2815 and 2816 type EEPROMs; hexadecimal rotary switches allow easy page and base address selection in a 1 Mbyte address space.
o	-	o	-	-	-	8K/16K boundary, address deselection.
-	-	-	o	o	-	Also accepts 27128 EPROM.
-	-	-	-	-	-	MIL-Spec. Optional 2K, 4K, 8K, 16K.
-	-	-	o	-	-	Multimodule; doubles the on-board memory, for the iSBC 86/12A to 32 Kbytes.
-	-	-	-	-	-	Multimodule; expansion for iSBC 86/05, 88/25, 88/40.
-	-	-	-	-	-	Universal site expansion board with sixteen 28-pin universal sites.
-	o	o	o	-	-	
-	-	-	-	-	-	Alternate source for iSBC-416.
-	o	o	o	o	-	Alternate source for iSBC-464 with double capacity.
-	-	o	o	o	-	On-board MMU allows 64KB limited 8/16 bit systems to access 1MB without modifications to existing software or hardware; Manufacturing license available.
-	-	o	o	-	-	Bank switchable in 32K blocks of 4K or 16K blocks of 2K PROMs; Banks may be overlapped; optional 8 MHz on-board oscillator.
-	-	-	o	o	-	27138's may be used providing 512 Kbyte capacity.

Dear MULTIBUS<sup>®</sup> Manufacturers Group Member:

Several of you have now asked us to try to set forth a clear and simple guideline on how to mark your documents to give due credit to the originators of trademarked claimed and registered trademarks. Intel is keenly interested in maintaining a high standard of conformance to this widely accepted practice, so we are pleased to put forth here just such a guide.

There are two marks used in documents:

<sup>T.M.</sup> Indicates our claim to a trademark for a work or acronym and our intention to register it when the necessary criteria have been met.

<sup>®</sup> Indicates we have applied for and been granted incontestable and exclusive ownership rights to that trademark.

That period during which a trademark is claimed prior to registration can vary, but is usually one to two years. Upon registration, we will change our mark in our publications and ads from <sup>T.M.</sup> to <sup>®</sup>. That's it! It's just that easy . . . although there are a few other subtleties.

Trademarks must never be used generically (i.e., as nouns) to describe a process or device (e.g., a "MULTIBUS" instead of a "MULTIBUS system.")

Your writers need to keep a list handy of all the trademarked and registered words and acronyms used in your market segment. They need to mark your literature and ads accordingly with the appropriate symbol. But you only use the <sup>®</sup> or <sup>T.M.</sup> for your own trademarks. You use an asterisk (\*) to indicate somebody else's trademark with a footnote at the bottom of a page indicating "<sup>®</sup> is a registered trademark of XYZ Corporation" or "<sup>T.M.</sup> is a trademark of ABC Corporation"; with a cover, you footnote inside the cover in a clearly visible place. (Witness the mark on the word MULTIBUS\* on the cover of the MULTIBUS\* Buyers Guide.)

What if you are referencing an Intel trademarked or registered word several times on a page? Do you need to mark every use of the word with a symbol? No, once per document is enough, but you should also mark each additional occurrence of the word or acronym in:

- a. Titles
- b. Table of Contents Listings
- c. Chapter/Section/Page Headings
- d. Paragraph Titles
- e. Table Titles
- f. Table Column Headings
- g. Figure Titles
- h. Figure Callouts

Rob Hughes  
OMO Strategic Marketing  
Intel Corporation  
0261E

**intel**<sup>®</sup> delivers  
solutions



# Combination Memory — I/O Expansion

---

Advanced Micro Devices  
Diversified Technology, Inc.  
Intel Corporation  
MBI, Inc.  
National Semiconductor Corp.  
TITN, Inc.  
TSD Display Products  
Zendex Corporation

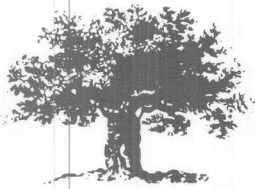
## Combination Memory – I/O Expansion

Manufacturer	Model	Price	DFA	Deliv.	Cap./Supplied (Kbytes)		Parallel I/O Lines
					RAM	ROM	
AMD ..... (408)988-7777	96/5232	\$ 895	6/83	stk	128/0	256/0	24
Diversified Technology ..... (601)856-4121	CBC8116	\$ 925	2/83	-	64/16 16/16*	-/- 16/16*	22
Intel Corporation ..... See Sales Office Listing	iSBC 108A	\$ 980	-	-	8/8	32/-	48
	iSBC. 116A	\$1185	-	-	16/16	32/-	48
MBI, Inc. .... (617)964-1399	MBZ-64	\$1650	-	-	64/64	32/-	20
National Semiconductor ..... See Sales Office Listing	BLC-104	\$ 780	-	-	4/4	8/-	48
	BLC-116	\$ 800	-	stk	16/16	8/-	48
TITN, Inc. .... (415)348-9181 (612)831-4422	TN68/18	\$1310	7/82	6wk	8/8	-/-	0
TSD Display Products, Inc. .... (516)589-6800	M60141	\$ 700	-	stk	-/-	32/-	24
Zendex Corporation ..... (415)828-3000	ZX-118	\$1504	-	-	16/16	-/-	-

Serial I/O (RS-232)	Counter Timers (No./bits)	Data Bus (bits)	Address (bits)	Interrupt Levels/Sources	Distinguishing Features
1	5/-	8-16	20-24	8/11	SBX connector, Sixteen 24/28 JEDEC sockets for byte-wide RAM/ROM EPROM.
2	3/16	8	16	3/10	Complete CMOS design for low power operation; 540mW of power dissipation; CBX bus connector allows incremental expansion.
1	1/-	-	-	1/9	iSBC 86 compatibility.
1	1/-	-	-	1/9	iSBC 86 compatibility.
4	4/8	8-16	20	1/1	Dual-port memory and on-board Z-80.
1	1/-	-/-	-	1/8	Replaces iSBC 104.
1	1/-	-/-	-	1/8	Replaces iSBC 116.
-	-	8-16	20	-/-	On-board battery back-up; data retention 10 days, typical.
2	3/-	-/-	20	7.7	Includes keyboard interface.
4	-/-	-/-	-	-/-	

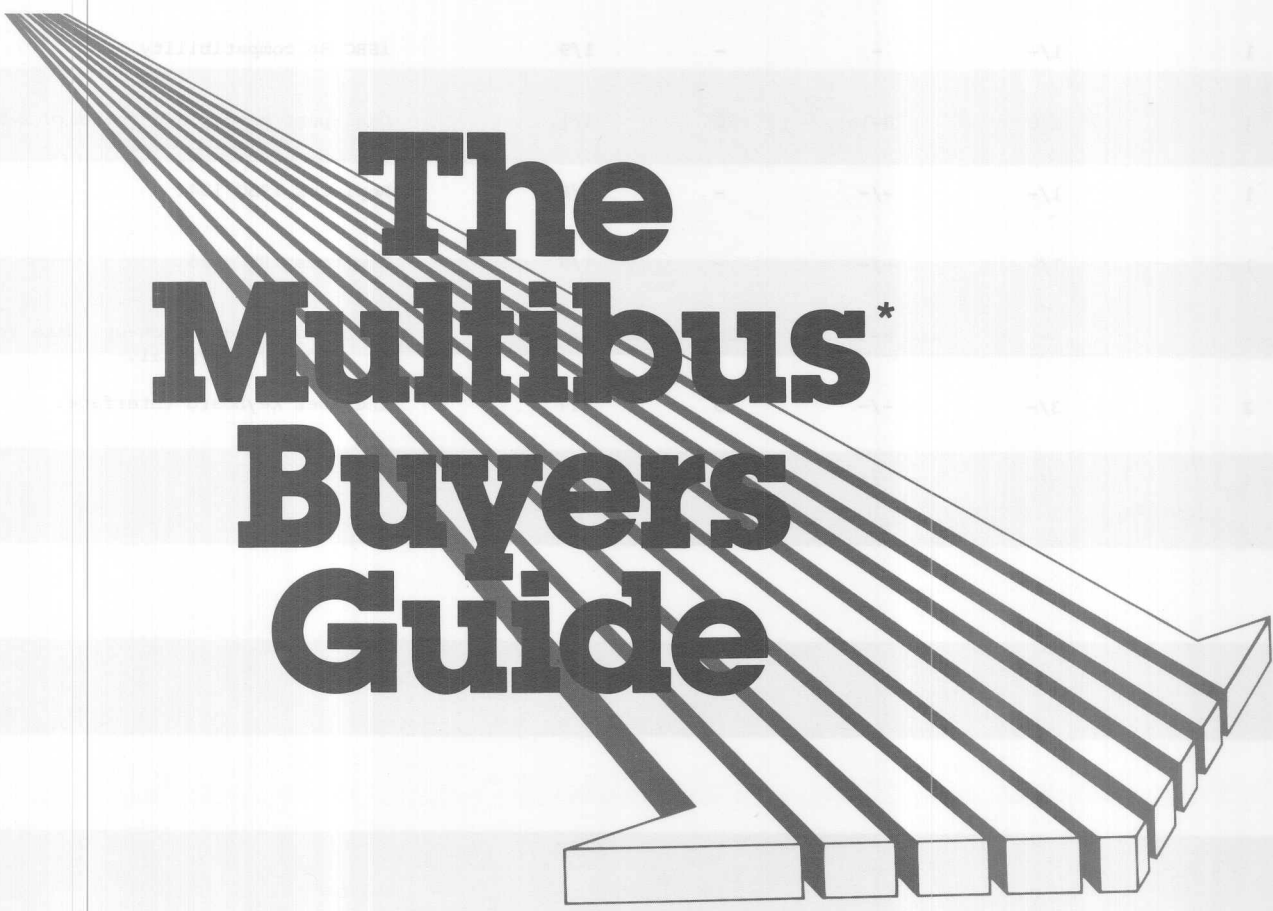
The S-100 Bus Buyers Guide  
 The STD Bus Buyers Guide  
 The VMEbus Buyers Guide  
 The Multiplex Bus Buyers Guide

75



**IRONOAK COMPANY**

3239 Caminito Ameca  
La Jolla, CA 92037  
(619) 450-0191

A graphic consisting of multiple parallel lines that converge from the bottom left towards the top right, creating a strong sense of perspective. The lines are black on a white background.

# **The Multibus<sup>\*</sup> Buyers Guide**

**Ironoak publishes:**

**The Multibus<sup>\*</sup> Buyers Guide  
The VMEbus Buyers Guide  
The STD BUS Buyers Guide  
The S-100 BUS Buyers Guide**



# Serial I/O Expansion

---

AMD

Central Data Corporation

Christian Rovsing Corp.

Cosmos Systems, Inc.

Densan Co., Ltd.

Distributed Computer Systems

Intel Corporation

National Semiconductor Corp.

NEC Electronics U.S.A.

Omnibyte Corporation

Thomas Engineering Co.

TSD Display Products

Zendex Corporation

## Serial I/O Expansion

Manufacturer	Model	Price	DFA	Deliv.	Type	No. Ports
AMD ..... (408)988-7777	95/3310	\$ 710	1/81	stk	Communication I/O	4
Central Data Corporation ..... (217)359-8010	B1043	\$ 465	4/83	stk	Octal Serial Interface	8
	B1038	\$370	3/83	stk	Quad Serial Interface	4
	B1044	\$ 810	4/83	stk	Intelligent Octal Board	8
Christian Rovsing Corp. .... (805)497-6722	SCI	\$-	-	-	Serial Communication Intfc.	4
Cosmos Systems, Inc. ....	-	\$-	-	-	8-Channel Serial I/O	8
Densan .....	DSB 532	\$-	-	-	Dual Serial Interface	2
Distributed Computer ..... (617)890-8200	DLS/5108	\$2800	*12/83	-	Serial I/O Expansion	4
Intel Corporation ..... See Sales Office Listing	iSBX 351	\$ 230	-	-	Programmable Serial I/O	1
	iSBX 352	\$ 395	-	-	Programmable Serial I/O	1
National Semiconductor .....	BLX 351	\$ 230	-	stk	Programmable Serial I/O	1
NEC Electronics ..... (617)655-8833	BPO575- 001	\$ 695	12/81	stk	Multi-channel Serial I/O	5
Omnibyte Corporation ..... (312)231-6880	OB68K230	\$ 795	83		Octal Serial Expansion	-
	OB68KINT	\$ 695	83		Host Adapter Board	4
Thomas Engineering Co. ....	MZ-SI08	\$ 800	6/82	-	Serial I/O Board	8
	MZ-MSI0	\$1000	6/82	-	Serial I/O Board	4
TSD Display Products ..... M60146		\$ 725	81	-	Programmable Serial I/O	5
Zendex ..... (415)828-3000	ZX-118	\$1495	-	stk	Quad Serial I/O Board	4

## Distinguishing Features

4 RS-232C programmable channels, 24 input or output parallel lines, two counter/timers. Up to 4 modems and one Bell 801-type automatic call/answer unit.

EIA RS-232C ports; baud rates: 50 to 19, 200 baud; Requires 32 I/O ports; 8 or 16-bit addressing, Locking headers for pin compatibility with DB-25, also 2661 USARTs.

EIA RS-232C ports; programmable baud rates 75 to 19,200, 16 I/O ports. Locking headers for pin compatibility with DB-25.

2650 based intelligent controller; 16K dual-port RAM; up to 4K of PROM; RS-232C ports; 8-bit word size; 8 or 16-bit addressing; access time 450 to 900ns; to 19,200 baud. Locking headers for pin compatibility with DB-25. Also 2661 USARTs.

280A based microcomputer board including a slave Multibus interface and four serial channels, supports 32K or 64Kbytes of RAM or PROM.

Eight independently programmable baud rates, user programmable interval timers.

Two channels, RS-232C or 20mA, 75 to 4800 baud.

Adds 8 high performance serial I/O ports to 1M baud. On-board 8088 and 16K of triported RAM, 4 RS-232 and RS-422.

Buffered USART with 2 programmable BCD or binary timers; RS-232C or RS-422/449 interface. Multimodule.

HDLC/SDLC; Half/full duplex, point-to-point, multidrop or NRZI SDLC loop, RS-232C and RS-422A/449 interface, programmable baud rates to 64K baud.

Alternate source for ISBX 351.

Adds 5 asynchronous serial channels; RS-232C or optically isolated 20mA current loop.

24-bit addressing uses Signetics SC68681 DUARTS (68000) family, each I/O port can be configured as either RS-232 or RS-422.

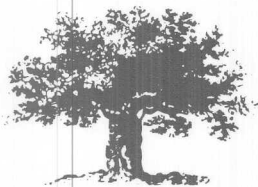
Each port can be configured as RS-232 or 422. Includes interface for SMS 5001DTC. 1403D floppy and hard disk controlled. Centronics port and real-time clock/calendar with battery.

Optional 20mA current loop.

Includes 32Kbyte RAM.

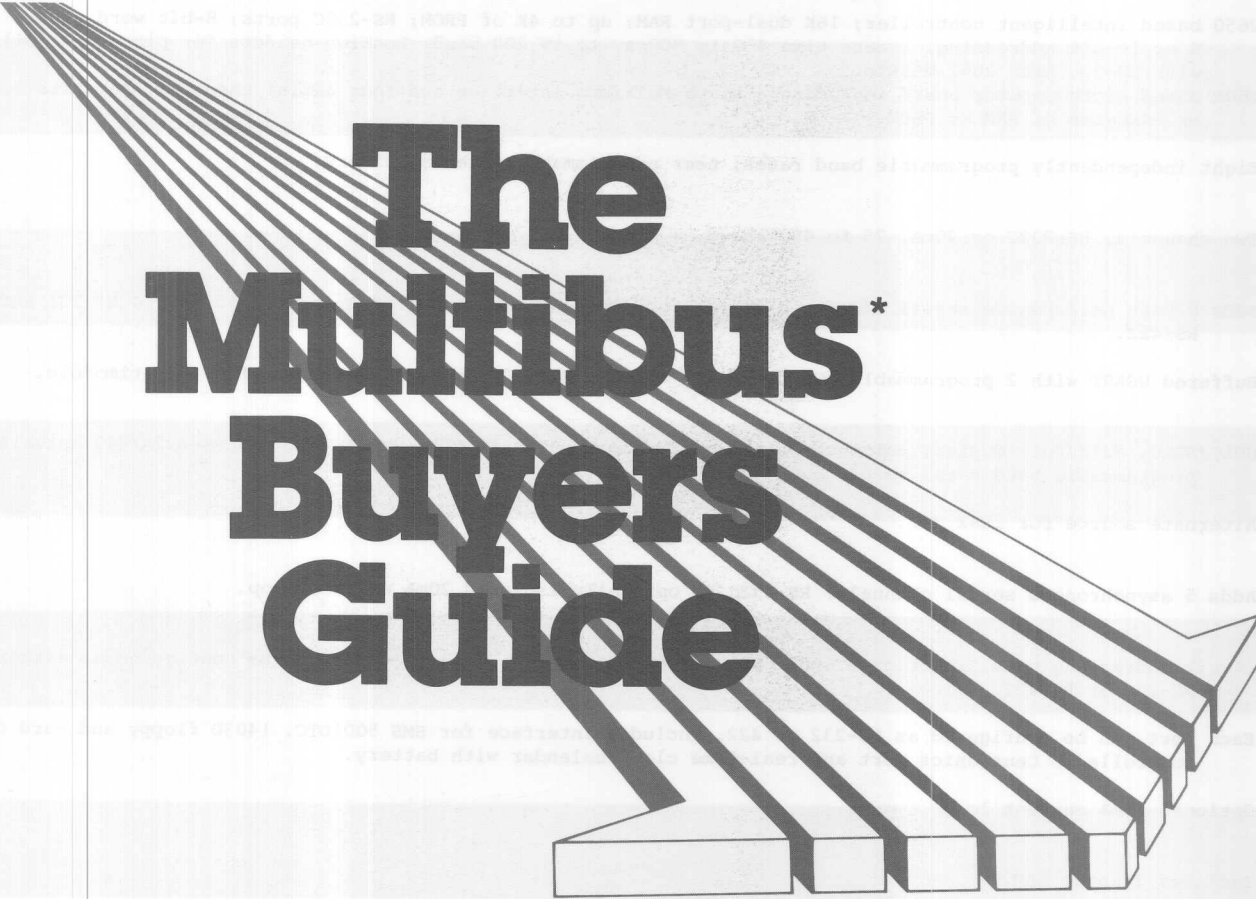
Adds 5 EIA RS-232 ports; CRC generator checker; interface to Bar Code Wand and proportional spacing printer.

Four serial RS-232C ports utilizing 8251A USARTs, an on-board DMA controller, 16K of high speed static RAM and memory management.



**IRONOAK COMPANY**

3239 Caminito Ameca  
La Jolla, CA 92037  
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A graphic consisting of numerous parallel lines that originate from a single point on the left and fan out to the right, creating a perspective effect that frames the title text.

# **The Multibus\* Buyers Guide**

**Ironoak publishes:**

**The Multibus\* Buyers Guide  
The VMEbus Buyers Guide  
The STD BUS Buyers Guide  
The S-100 BUS Buyers Guide**



# Parallel/Serial I/O Expansion

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Anitech Systems, Inc.  
Burr-Brown  
Densan Co., Inc.  
Electronic Solutions  
EMM/Sesco  
ETI Micro  
General Digital Corp.  
GIC Systems  
Intel Corporation  
Inventive Systems  
J & H Manufacturing  
Matrox Electronic Systems  
Micro Industries  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Omnibyte Corporation  
Opto 22  
Sibthorp Systems, Inc.

## Parallel/Serial I/O Expansion

Manufacturer	Model	Price	DFA	Deliv.	Parallel Lines			Serial Ports (RS-232)	Timers (No./bits)
					Input	I/O	Output		
Anitech Systems Inc. ....	1001	\$ 495	1/82	-	16*		16	-	-
Burr-Brown ..... (602) 747-0711	MP 801	\$ 335	-	-	-	-	16 32*	-	-
	MP 830-72	\$ 450	6/82	-	-	72	-	-	-
	MP 810	\$ 410	-	-	24	-	-	-	-
	MP 810-NS	\$ 335	-	-	24	-	-	-	-
Densan .....	DSB-519	\$-	-	-	-	72	-	-	1/-
Electronic Solutions ..... (714) 292-0242 (800) 854-7086	SIM-64	\$ 395	-	stk	64	-	-	-	-
EMM/Sesco .....	SECS80/519	\$2700	-	-	-	72	-	-	-
ETI Micro ..... (415) 829-6600	8123	\$1040	-	stk	48	-	-	-	1/-
	8122	\$1012	83	stk	48*	-	48	-	-
General Digital ..... (203) 528-9041	GDX- Relay-8	\$ 120	9/82	stk	8	-	-	-	-
GIC Systems ..... (201) 743-6800	G519I/O	\$ 435	1/82	stk	-	72	-	-	3/16

## Distinguishing Features

Optically isolated, Memory or I/O mapped, 1.0 amp fused output.

600V isolation; 28V RMS, 0.5A reed relay.

72-channel TTL levels; user configured in 8-channel increments of inputs or outputs.

600V isolation; dry contact closure, 1.5mA wetting current at 24 VDC.

600V isolation; DC voltage input; 17 to 84 VDC; optional low DC voltage level, 1 to 5 VDC (TTL-compatible); AC voltage level, 65 to 250 VAC.

8 interrupt levels.

Detects up to 64 switch or relay inputs; input voltages to  $\pm 30$  VDC; optional terminating resistors; memory-mapped I/O.

MIL-Spec. version of iSBC 519.

Opto-isolated; 1500V isolation. 8 or 16-bit data path; 8088 CPU; 4K dual-port RAM; Resident preprocessing firmware.

Opto-isolated (1500V) on-board 8088 with resident preprocessing firmware, 4Kbytes of dual-port RAM.

8-bit isolated relay port expansion module. Sockets for user-supplied DIP relays. Form A or C switching. Use as uP controlled switches, relay scanner or matrix switching.

72 I/O lines; 24mA current sink; includes 8253 timer. 8259A interrupt controller; +5V only.

continued next page

## Parallel/Serial I/O Expansion

Manufacturer	Model	Price	DFA	Deliv.	Parallel Lines			Serial	Timers
					Input	I/O	Output	Ports (RS-232)	(No./bits)
Intel Corporation ..... See Sales Office Listing	iSBC 569	\$ 800	-	-	-	45	-	1	3/-
	iSBC 517	\$ 470	-	-	-	48	-	1	1/-
	iSBC 519	\$ 550	-	-	-	72	-	-	1/-
	iSBC 589	\$1985	-	-	-	-	-	-	-
	iSBX 350	\$ 155	-	-	-	24	-	-	-
	iSBC 580	\$ 775	-	-	-	-	-	-	-
Inventive Systems .....	ISI-MPI	\$1995	9/82	-	32	-	32	-	-
J & H Manufacturing .....	20750	\$ 495	-	-	-	48	-	-	1
Matrox Electronic Systems ..... (514)735-1182	COM-1	\$-	-	-	-	-	-	-	-
Micro Industries .....	MIB 517	\$ 540	6/83	-	-	48	-	-	-
(614)895-0404									
National Semiconductor .....	BLX-350	\$ 155	-	stk	-	24	-	-	-
See Sales Office Listing									
	BLC-508	\$ 385	-	stk	32	-	32	-	-
	BLC-517	\$ 437	-	stk	-	48	-	1	1
	BLC-519	\$ 550	-	stk	-	72	-	-	1
NEC Electronics U.S.A. ....	BPO600	\$ 595	12/82	stk	-	72	-	-	5/16
(617)655-8833									
Omnibyte Corporation .....	OB68K230	\$ 450	3/82	-	-	96	-	N/A	4/24
Opto 22 .....	PAMUX II	\$ 295	1/82	stk	-	32	-	N/A	N/A
(714)891-5861									
Sibthorp Systems, Inc. ....	PIO-200	\$ 575	12/82	stk	-	128	-	-	-
(606)525-1300									



## Distinguishing Features

8085A processor for control algorithms and three UPI-41A peripheral interface processors;  
2K dual-port RAM; 3 timers.

8 maskable interrupt lines.

Programmable interrupt controller; jumper selectable interval time. (real-time clock).

Intelligent DMA controller for Multichannel I/O Bus interfaces supervisor, controller or basic  
talker, listener capabilities; 8089 16-bit I/O processor; user command interface firmware  
package; 2 SBX connectors; intelligent.  
Multimodule, parallel I/O expansion.

Multichannel bus to iLBX bus interface; iLBX busmaster and Multichannel I/O bus 16-bit talker/  
listener; data rates to 5.3Mbytes/sec; address 16Mbytes iLBX memory.

16 control lines; true full duplex mode.

512bytes CMOS RAM with battery back-up; 8 levels of interrupt.

Eight interrupt request lines, combination I/O expansion board.

Parallel I/O expansion module, alternate source for iSBX 350.

Alternate source for iSBC 508.

1 serial sync./async. channel; baud rates to 38.4K, alternate source for iSBC 517.

Programmable interrupt controller; plug replacement for iSBC 519, alternate source for iSBC 519.

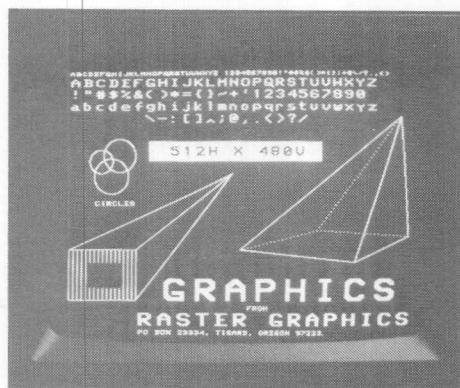
iSBC 519 superset; on-board provision for custom signal termination/drive; user expansion area;  
time-of-day clock.

Software programmable for 8/16/32-bit I/O ports. 45% prototyping area.

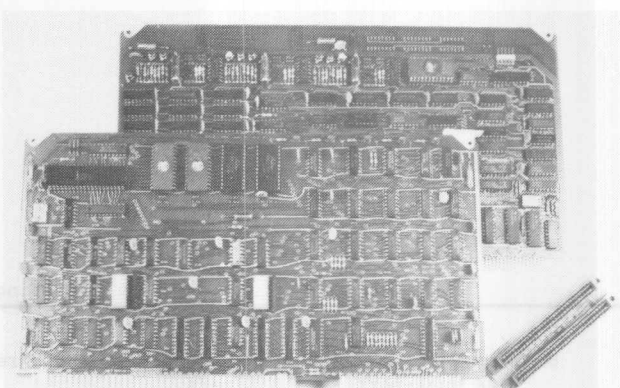
Provides expandable digital power I/O through a parallel port option (SBC/BLC/519). Expandable  
to 512 points via one daisy chain cable.

High speed; low power consumption. 16 8-bit ports. Memory mapped, (8/16/20-bit address) or  
I/O mapped (8/16-bit address). Two ports may be bi-directional, Opto 22 compatible interface.

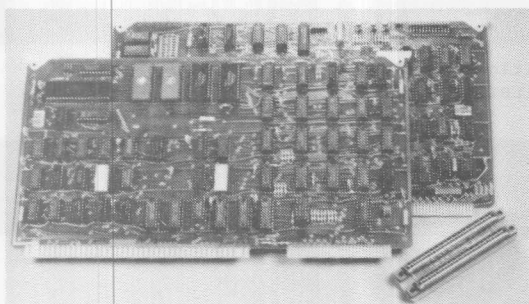
# MULTIBUS\* GRAPHICS BOARDS *and more!*



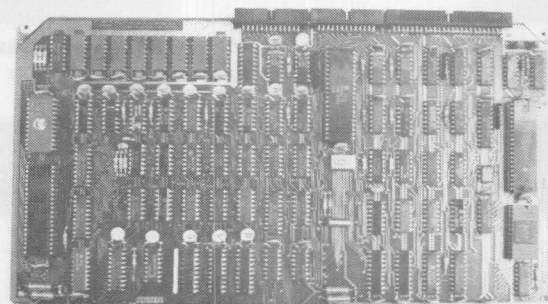
**RG-GG9 VERY SMART B&W** Single board graphics generator produces text and graphics. Interlace or non-interlace, 512h x 240v, 512h x 480v @ 60hz; 512h x 290v, 512h x 580v @ 50hz. Draws circles, lines from endpoint coordinates, cursor, vertical scrolling, etc. Composite & TTL output.  
Price..... \$795.00



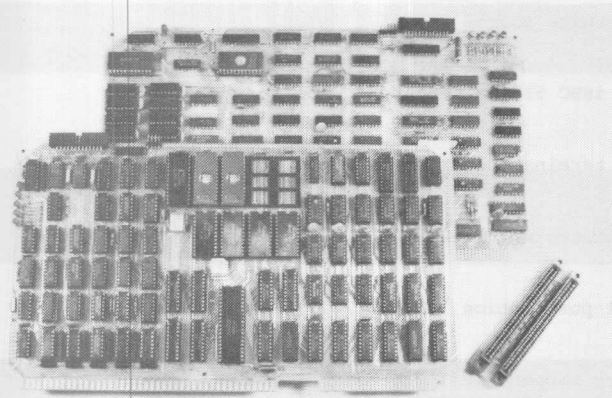
**RG-GG8C SMART RGB COLOR** Graphics Generator generates 8 color text and graphics. Interlace or non-interlace, 512h x 240v, 512h x 480v @ 60hz; 512h x 290, 512h x 580v @ 50hz. Draws circles, lines from endpoint coordinates, cursor vertical scrolling, etc. Add memory board for 64, 512 or 4096 colors. Composite & TTL outputs.  
Price ..... \$1695.00



**RG-GG7 SMART B&W** 512H x 480V Graphics Generator produces text and graphics. Light pen I/O, dual refresh memories, vertical scrolling, cursor, refresh memory readback, user defined character set, draws lines from endpoint coordinates.  
Price..... \$1295.00



**RG-802 SINGLE BOARD COMPUTER** features 64k ram, Z80A CPU, 2 RS-232 ports, double/single density floppy disc I/O, 8 interrupts, & multimaster. Available with CP/M+ 2.2.  
Price..... \$695.00  
CP/M 2.2, boot prom, & bios..... \$175.00



**RG-GG11 VERY SMART B&W** 1024h x 480v graphics generator produces text and graphics on low cost b&w tv monitors. 1k x 1k memory, horizontal & vertical scrolling, RS-232 printer/peripheral port, interlace/non-interlace. 525/60hz, 625/50hz, 875/60hz.  
Price ..... \$1595.00



**RG-808 STANDALONE COMPUTER** features 2 Shugart 801 8" drives, RG-802, Televideo 910, 8 slot card cage, and heavy duty power supply.  
Price ..... \$5295.00

## Need a Custom Design?

Prices shown are for single unit quantities.  
OEM discounts available for 10 or more units.

## RASTER GRAPHICS INC.


P.O. Box 23334  
Tigard, Oregon 97223  
Tel. (503) 620-2241

\*Multibus is a trademark of Intel Corp.

\*\*Z80A is a trademark of Zilog Corp.

+CP/M is a trademark of Digital Research Corp.

# Video Controllers



AMTELCO  
Artec Electronics  
Century Computer Corporation  
Datacube, Inc.  
Forward Technology, Inc.  
Frontier Technologies Corp.  
General Digital Corp.  
General Electric Co.  
Graphics Development Labs  
Heurikon Corporation  
Ikier Technology  
Imaging Technology, Inc.  
Intel Corporation  
Interactive Images  
Interphase Corp.  
Logitech, Inc.  
Matrox Electronic Systems  
Metacomp, Inc.  
Micrographics Research  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Phoenix Computer Graphics  
Raster Graphics, Inc.  
Scion Corporation  
TITN, Inc.  
TSD Display Products  
Vermont Microsystems, Inc.  
Xedax Corporation

# SINGLE-BOARD COLOR

1024 x 1024 x 4 · 16 COLORS · \$1,980 QTY 100

NEC 7220 with hardware vector/raster conversion, multiple viewing windows, pan and scroll

Up to 80MHz output, analog (RGB) or digital (TTL)

Three ultra-fast 4-bit DACs on a single custom hybrid IC for more colors and higher speed in less space

512Kbyte video RAM uses high-density 256K SIPs.

Optional 512 x 512 format (\$875 qty. 100)

Multibus form factor

16 colors displayable simultaneously from a palette of  $2^{12}$ ; up to 2 million pixels per plane.

Multibus is a trademark of Intel Corporation.

For more information, contact IKIER, 42 Pleasant St., Watertown, MA 02172, (617) 924-3113.

**IKIER**  
TECHNOLOGY, INC.

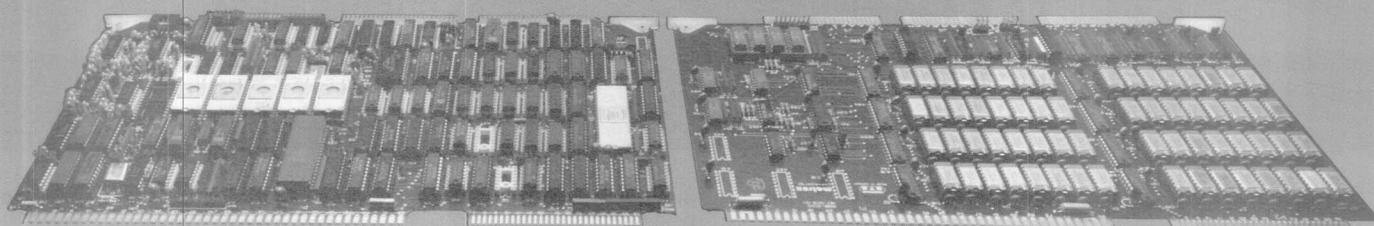
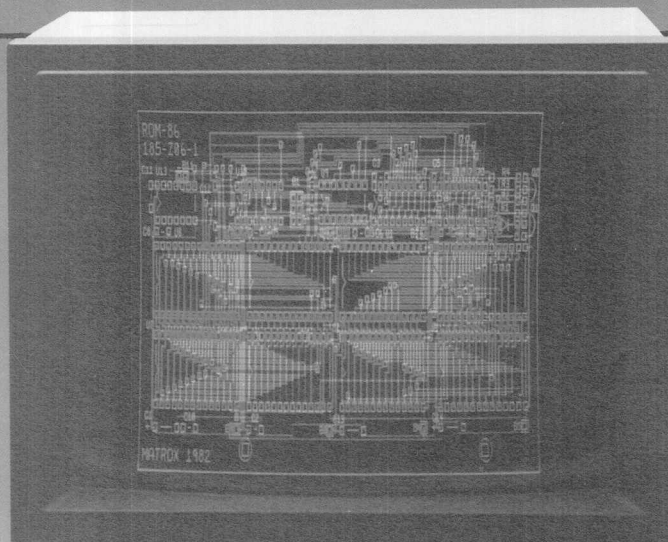


# COLOR GRAPHICS BOARDS 1024 x 1024

■ BUILT-IN  
SOFTWARE

■ \$3225.00  
COMPLETE \*

■ MULTIBUS  
COMPATIBLE



## MATROX GXB-1000 - The complete color graphics solution.

**DISPLAY RESOLUTION:** 1024 x 768 pixels non-interlaced at 60Hz or up to 1600 x 1200 pixels interlaced at 30Hz

**READ/WRITE AREA:** 1024 x 1024 x 4 bits/pixel expandable to 1024 x 1024 x 16 or 2048 x 2048 x 4

**SPEED:** Four pipelined on-board processors draw graphics primitives at speeds of 50 to 800 nsec/pixel

**COLOR:** 16 display colors can be selected from a palette of 256 different shades

**SOFTWARE:** On-board 16 bit CPU with resident graphics software interprets over 256 commands and supports local segments, 2D primitives, tablet tracking, rubber banding, etc.

**MODULARITY:** GXB-1000 is fully Multibus compatible (IEEE-796), and operates from a single + 5V supply

Multibus - TM Intel \*QTY 100

The GXB-1000 is a complete color graphics display system implemented on two Multibus boards. The system executes a display file containing high level graphics commands, generated by the user's host CPU. The GXB-1000 includes all the necessary hardware and software to draw lines, polygons, circles, characters, etc.

The GXB-1000 represents true state of the art performance. The boards generate the highest display resolution available from a raster scan device. The multi-processor pipelined architecture provides the highest possible drawing speeds.

Over six man years of Matrox programming effort have gone into the development of the on-board graphics software. An extensive command set allows the user to construct complex images with a minimal number of host CPU instructions and time.

The unmatched performance and low cost of GXB-1000 make it the perfect solution for OEM color graphic displays. Additionally, Matrox can provide RGB monitors, CPU boards, memory boards, cardcages and keyboards for complete display system requirements.



**matrox**  
electronic systems ltd.

US & CANADA

5800 Andover ave., T.M.R., Qué. Canada H4T 1H4  
Tel.: (514) 735-1182 Telex: 05-825651

EUROPE

Herengracht 22, 4924 BH Drimmelen, Holland  
Tel.: 01626-3850 Telex: 74341 MATRX NL

# Video Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type	Lines	Cols.	Chart Matrix	Resolution H. x V. (pixels)
AMTEL CO .....	217A032	\$ 615	3/82	stk	Alphanumeric/CRT	25	80	9 x 7	560 x 200
Artec Electronics ...	SBV-80	\$ 750	-	-	Graphics Controller EIA RS 170	15	32	9 x 7	256 x 240
Centrux Computer .... (214) 233-3238	V8006	\$ 800	-	stk	Graphics	25	80	-	-
Datacube ..... (617) 535-6644	VT 103	\$ 495	80	stk	Alphanumeric CRT/ Keyboard Controller	16	96	7 x 9	-
	VR 107A	\$ 540	79	stk	Alpha/Graphics	24 12	80 40	7 x 7 7 x 9	160 120-144
	VR 110A	\$ 450	79	stk	Alpha CRT Keyboard	16	64	7 x 9	-
	VG-120	\$2495	81	stk	Graphics	-	-	-	320 x 240
	VG-220	\$2495	81	stk	Graphics	-	-	-	640 x 240
	VG-124	\$4495	1/83	stk	Graphics/Frame Grabber	-	-	-	640 x 480
	VG/AF- 123	\$7500	5/83	stk	Graphics/Frame Grabber	24	80	7 x 9	768 x 512
	VG/150	\$-	*7/83	-	Graphics	-	-	-	1100 x 1400
	VG-121/ 221	\$3995	2/82	60da	Graphics	-	-	-	320 x 512 640 x 512
Forward Technology ..	FT-1024	\$1460	1/82	30da	Graphics Controller	66	80	9 x 16	1024 x 1024
Frontier Tech- ..... nologies (414) 964-8689	CEO	\$1195	*11/83	-	Graphics Controller	-	-	-	640 x 480
	INR	\$1295	*11/83	-	Graphics Controller	-	-	-	1024 x 1024
General Digital ..... (203) 528-9041	GDX- COLOR-1	\$ 245	6/83	-	Color Alphanumeric/ Graphics	24	40	6 x 8	256 x 192

# Video Controllers

B & W	Color	Data Bus (bits)	Address (bits)	Distinguishing Features
o	-	8	16	Light pen interface.
o	-	8/16	16-24	4 Channels of 2K character and 2K of attribute memory. Easily programmed. Underline, reverse blink, half intensity, blink to half intensity and blink to reverse.
-	-	-	20	Memory mapped. 2040bytes of attributes. Addressing on X-Y basis. Designed as above-board plus into Century's V8003 CPU. 5V only.
-	-	8	-	Full 96-character ASCII font; high density display.
-	-	-	20	Programmable display format; memory mapped raster-scan display.
-	-	-	-	
o	*	-	16/20	High-density video binary storage and re-generation.
o	*	-	16/20	Full computer access to storage; EIA spec video.
o	-	-	-	Similar to VG-131/221 input and output, RAM look-up tables, write protect on any or all 6-bit planes.
o	o	-	-	RAM based input and output translation tables alphanumeric overlay: PAN. Scroll and Zoom.
o	-	-	-	Moves the entire screen in under 2 seconds, line draw and BITBLT implemented in microcode.
o	o	-	-	Similar to VG-120/220, plus line acquire; multiple boards; scroll; enhanced phase lock timing, dynamic reading of data while acquiring; software selectable sync. source.
o	-	16	20	1024 x 1024 x 1 frame buffer is a dual-ported memory with one port dedicated to video refresh.
*	o	-	-	Uses NEC controller, up to 4 planes of 640 x 480 with only half the memory software emulation of 40XX and 3279 type terminals.
-	o	-	-	Intelligent high resolution board using NEC 7220 and 8088 CPU. Built-in primitives. Emulation of 40XX and 3279.
o	o	8	N/A	iSBX Multimodule, low cost expansion module, color text and graphics controller, uses TI-9918A video display processor, multi-plane display (back-drop, pattern plane, 32 "sprite" planes), 15 colors plus transparent.

continued next page



# Video Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type	Lines	Cols.	Chart Matrix	Resolution H. x V. (pixels)
Graphics Dev.Labs ... (408)980-7135	A-1000	\$1495	-	-	Colorgraphics Controller	-	-	-	-
Heurikon Corporation. (608)271-8700 (800)356-9602	MLZ-VDC	\$2775	10/82	-	Alpha Graphics	-	-	-	640 x 480
Ikier Technology .... (617)275-4330	HRG Series	\$1900	3/82	stk	Graphics Controller	-	-	-	512 x 1024 x 800 x 2 1280 x 1024*
	MPC Series	\$1600	10/82	stk	Multiplane Controller	-	-	-	1280 x 1024 x 8
	HRG-II	\$3600	3/83	stk	Graphics Controller	-	-	-	1024 x 800
	HRGS	\$ 800	*12/83	90da	Imaging/Graphics Controller	-	-	-	1280 x 1024
Imaging Technology ..	FB-512	\$3995	4/82	6wk	Image Processor/Color Graphic Controller	-	-	-	512 x 512 x 8
	AP-512	\$2995	4/82	6wk	Analog Processor Module	-	-	-	-
	ALU-512	\$2995	4/83	-	High Speed Pipe-Line Video ALU	-	-	-	-
	RGB-512	\$2995	4/83	6wk	Color Video Digitizer	-	-	-	-
Intel Corporation ... See Sales Office Listing	iSBX 275	\$ 995	-	-	Video Graphics Con- troller	-	-	-	256 x 256 512 x 512
	iSBX 270	\$ 750	-	-	Alphamosaic CRT/Key- board Controller	24	80	5 x 7 6 x 8 7 x 9	-
Interactive Images .. (617)938-8440	GDC-DP	\$3495	1/83	30da	Color Graphics Controller	-	-	-	960 x 720 1024 x 768
Interphase Corp. .... (214)350-9000	VMC 186	\$ 485	-	-	Alphanumeric/Graphics	24	80	5 x 7 7 x 9*	-
Logitech, Inc. .... (415)326-3885	PY1024- GRP	\$1050	12/82	2wk	Graphics Controller	-	-	-	640 x 848 640 x 480



# Video Controllers

B & W	Color	Data Bus (bits)	Address (bits)	Distinguishing Features
-	o	16	-	On-board 16-bit 8088 Processor.
o	o	8	24	On-card Z80A; optional FIFO buffer. Up to 32K of EPROM/ROM and 16K of RAM. 16 color display. Light pen interface.
o	-	8-16	20	Optional Interlaced/Non-Interlaced format; output to video monitor via ECL digital video channel; controller capable of generating arcs, vectors, circles & rectangles; DMA block transfers.
o	2 <sup>24</sup>	8-16	20	Same as HR6 series except for color.
o	2 <sup>12</sup>	8-16	24	On-board DAC (16 colors from palette of 4096) optional daughter board for up to 6 planes.
-	2 <sup>24</sup>	16	24	High speed dual port (Pl as iLBX) Full on-board Raster op. On-board Intel 186 CPU. Pixels are 16 bits deep.
o	o	-	-	Hardware pan, scroll and zoom (2). Option: Memory mapped frame buffer, avail. 1/84. Accepts RS-170 input and in 1/30 sec. stores a frame in a 512 x 512 Frame Buffer with up to 24 bits/pixel.
-	-	-	-	Precision front end with flash A/D, sample and hold circuitry. Digitized by a 6 or 8-bit flash A/D at 5 or 10 million samples per second.
-	-	-	-	10MHz processor, UP to for frame buffer channels. 8-bit multiplication 16-bit addition, subtraction, and logical operations, 16-bit barrel shifter.
-	o	-	to 24	Digitizes RGB video input in 1/30th of a second per frame. 3 output channels with look-up tables and supports 1,3, or 4 frame buffers to 24 bits per pixel.
o	o	8	20	Displays 512 x 512 B & W or 256 x 256 8-color resolution; high level drawing commands with light pen interface.
o	o	8	20	Multimodule, keyboard and light pen interface; cursor control, reverse video blinking, underline, highlight and page or scroll mode.
-	o	16	24	RGB output, separate and comp. syncs. Video to/from display RAM via NEC 7220 or parallel port. 2nd port provides 5:1 speed-up. Writes RGB (white) simultaneously. Pan, scroll, zoom.
o	-	8-16	24	1024 x 1024 x 1-bit map. Hardware assisted and selective scroll (both H and V). Fully integrated interface for LogiMouse. Portrait or landscape display mode.

continued next page

# Video Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type	Lines	Cols.	Chart Matrix	Resolution H. x V. (pixels)
Matrox Electronic ... (514)735-1182	MSBC2480	\$ 520	-	-	Alphanumeric CRT/ Keyboard	24	80	6 x 10 8 x 10*	-
	BW-Alpha	\$ 495	-	-	Alphanumeric CRT/ Keyboard	48	132	-	-
	QV-2	\$1360	-	-	Alphanumeric CRT/ Keyboard	24	80	-	-
	NSBC-512	\$-	-	-	Graphics Controller	-	-	-	512 x 512
	RGB- ALPHA	\$ 885	-	-	Color Alphanumeric Controller	60	128	-	-
	MSBC-512	\$1255	-	-	Graphics Controller	-	-	-	512 x 512
	GXB-1000	\$4520	*	-	Super High Resolutions Color Graphics	-	-	-	1024 x 768 x 4 1600 x 1200*
	RGB-256	\$1465/ 1675	-	-	Graphics Controller	(Price depends on resolution)	-	-	256 x 256
	FG-01/ 835	\$ 895/ 2095	-	-	Graphics Controller	(Price depends on bits/pixel)	-	-	256 x 256
	RGB- GRAPH	\$ 895/ 2520	-	-	Graphics Controller	-	-	-	512 x 512
	VAF-512	\$1155	-	-	Graphics Controller	-	-	-	512 x 512
Metacomp, Inc. .... (619)578-9840	MCV- 1023-1	\$ 995	1/80	stk	Alpha/Graphics	24 16 12	80 60 40	6 x 10 8 x 15 12 x 20	512 x 256 512 x 512* 640 x 500
Micrographics Rsch...	GT1	\$1995	12/81	6wk	Alpha/Graphics	25	80	5 x 7	640 x 500
National Semicon- ... ductor, See Sales Office Listing	BLC-8228	\$ 993	-	-	Alphanumeric CRT/ Keyboard	24	80	5 x 7	-
	BLC-8229	\$1214	-	-	Alphanumeric CRT/ Keyboard	25	80	7 x 9	-
	BLC-8240	\$-	-	-	Color Graphics Processor	64 32*	64 80*	5 x 7 Column*	512 x 512 640 x 640*
NEC Electronics ..... (617)655-8833	BP1000	\$2495	3/82	stk	Graphics Controller	-	-	-	640 x 480
Phoenix Computer .... Graphics (318)234-0063	1024-B4	\$3500	10/82	30da	Alphanumeric/Graphics Controller	60	80	12 x 16	1024 x 1024 x 4 1024 x 1024 x 8* 2048 x 2048 x 8*

# Video Controllers

B & W	Color	Data Bus (bits)	Address (bits)	Distinguishing Features
o	-	-	-	
o	-	-	-	Scroll, programmable character attributes.
o	-	-	-	Controls up to 4, 24 x 80 independent displays; 8/16-bit data transfers.
o	-	-	-	Variable resolutions graphics controller; vector plot.
o	o	-	20	256 user-defined characters; keyboard and light pen interface.
o	-	-	-	Variable resolution graphics controller; vertical scroll; x-y addressing.
o	o	-	-	Single +5V, on-board 8088 CPU.
-	o	-	-	16-level grey scale or 16-color graphic displays.
-	-	-	-	256 x 256 or 4-bit frame grabber; designed to work with RGB-256; allows user to freeze a live TV frame.
-	o	16	20	DMA; 128Kbyte refresh memory; hardware zoom, pan, scroll shift, 4 boards can be synchronized for up to 16-bits/pixel.
-	-	-	-	Adds high video to RGB-Graph.
o	-	8	20	Intelligent single-channel alpha/graphics with software selectable multiple character sizes, 8085 based firmware for high-speed/intelligent slave operations. 512 x 256 resolution.
-	-	-	-	
o	-	-	-	On-board INS8080A; firmware editor with cursor; blink, blank, reverse, scrolling, editing.
o	-	-	-	
-	o	8	16	8MHz 8088 dual display buffers. Optional firmware, 4096 colors, zoom, single board.
*	o	-	-	Raster scan color or black and white graphics; vector arc, rectangle, and graphics drawing; split screen zoom and panning, software selectable video formats; alphanumeric capability.
o	o	-	-	256 colors usable to 16.8 million color palette, zoom, dual direct memory access, 2 boards.

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## Video Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type	Lines	Cols.	Chart Matrix	Resolution H. x V. (pixels)
Raster Graphics Inc. (503)620-2241	RG-GG1	\$ 495	6/79	stk	Graphics Controller	-	-	-	256 x 240
	RG-GG5	\$ 695	3/82	stk	Graphics Controller	-	-	-	512 x 480
	RG-GG2	\$1095	3/80	stk	Graphics Controller	-	-	-	240 x 480
	RG-GG3	\$1095	3/80	stk	Graphics Controller	-	-	-	512 x 480
	RG-GG9	\$ 795	*12/83	stk	Graphics Controller	-	-	-	512 x 240
	RG-GG7	\$1295	6/82	stk	Graphics Controller	-	-	-	512 x 480
	RG-GG10C	\$1895	*12/83	stk	Graphics Controller	-	-	-	512 x 240
	RG-GG11	\$1595	*12/83	stk	Graphics Controller	-	-	-	1024 x 480
	RG-GG8C	\$1695	3/83	stk	Graphics Controller	-	-	-	512 x 480
Scion .....	Micro-Angelo	\$1495	10/82	-	Graphics Controller	40	85	-	512 x 480
TTTN, Inc. (415)348-9181	TN/68-100	\$1800	*7/83	6wk	Graphics Controller	-	-	-	572 x 864
	TN/68-110	\$3600	1/84	6wk	Graphics Controller	-	-	-	256 x 256
TSD Display Systems... (516)589-6800	M60144	\$ 800	81	stk	Alpha CRT	24	80	-	-
Vermont Micro-Systems, Inc. (802)655-3800	VM8850	\$2150	8/82	stk	Graphics Processor	64 32	64 80*	5 x 7	512 x 512 640 x 480*
	VM8851	\$3750	*12/83	-	Graphics Processor	64 85	64 56*	5 x 7 (7 x 9)*	512 x 512
	VM8830	\$5950	*12/83	-	Video Digitizer	-	-	-	512 x 512
Xedax Corporation ...	711-1	\$ 477	79	stk	Alphanumeric CRT/ Keyboard	24	80	5 x 7 7 x 10	240 x 256
	711-2	\$ 451	79	stk	Graphics Controller	-	-	-	240 x 256



# WE ENGINEERED THE WHOLE ENCHILADA

## AND MULTIBUS\* DATA COMMUNICATIONS TOO

B & W	Color	Data Bus (bits)	Address (bits)	Distinguishing Features
o	-	-	-	Dual refresh memories, hardware vector generator; instructions written to I/O ports; composite and TTL; non-interlaced 525 output; writes at 1.6usec/pixel.
o	-	-	-	Dual refresh memories, hardware vector generator; instructions written to I/O ports; interlaced; 800nsec/pixel, vertical scroll, readback. TTL and composite 525/60Hz.
o	-	-	-	Two board set, Smart vector generator creates ASCII characters, vector draw from endpoints, circles. Dual refresh memories. TTL or composite non-interlaced output. 525/625.
o	-	-	-	Two board set. Smart vector generator creates ASCII characters, vectors from endpoint, rectangular fill TTL & composite interlaced output for 525/625 line TV.
o	o	-	-	Single board. Text and graphics, circles, point-to-point draw, cursor, TTL and composite output, 525/60Hz, and 625/50Hz. Interlaced and non-interlaced formats.
o	-	-	-	Two board set, smart vector generator, readback vertical scroll, dual refresh memories, circles, point-to-point draw.
-	o	-	-	Smart two board set, text and graphics, 8 colors expandable to 4096 colors. RS-232 printer port. Composite TTL 525/60Hz or 625/50Hz. Interlace or non-interlace.
o	-	-	-	Smart two board set. Text and graphics RS-232 printer port. 525/60Hz, 625/50Hz or 875/60Hz. TTL and composite outputs. Interlace and non-interlace.
-	o	o	o	Two board set, text & graphics, 8 colors, expandable to 4096 colors, 525/60Hz or 625/50Hz, Interlace or non-interlace.
o	o	-	-	Single board graphics display computer with high level on-board software.
o	-	16	20	Video: 625 lines, interlaced software access to each pixel. Block transfer at the byte level. Software available.
o	o	8	-	RGB output, 6 plans with 6 bits/pixel.
o	-	-	-	32Kbytes RAM; programmable DMA controller; up to 256 characters; reverse video; interrupt level options.
o*	o	8	16	Single board, 16-bit CPU dual buffers, image motioning, on-board graphics language. 16 colors from palette of 4096. Optional version 8850A with variety of character formats 8/16/20/24-bit address.
o*	o	8	8/16/ 20/24	Single board, 8-bit planes, 256 colors from palette of 16M, 60Hz non-interlaced, alternating CPU/Scan continuous write. Master mode, DMA, or programmed I/O bus interface.
o*	o	8/16	20/24	Single board multichannel video digitizer. 2 buffers of 8 bits or 1 buffer of 16 bits, expandable, 72K local memory, on-board CPU.
o	-	8	16/20	128 character-reverse, half intensity and underline; 5 character sizes; zoom, lower case desenders, 4K general purpose PROM sockets; interrupt or poll mode; memory-mapped 240 x 256 graphics.
o	-	8	16/20	Requires Xedax 711-1 Alphanumeric CRT Card.

Metacomp, Inc.



# WE ENGINEERED THE WHOLE ENCHILADA AND MULTIBUS\* DATA COMMUNICATIONS, TOO



The world of data communications is as full of variety as your imagination will let it be, but only Metacomp brings you the spice, flavor and color you need to reach it.

Until now, adding data communications capability to your Multibus system has meant a lot of guesswork, incompatibility and endless searching for the perfect hardware and software match. At Metacomp, we've done a lot to change that by bringing you nothing less than the whole enchilada.

We know it takes more than one networking protocol to achieve a complete data communications solution—that's why we've developed packaged

solutions to address the most popular protocols in the industry, all ported to Metacomp's MPA-2000, THE high performance CPU/intelligent I/O controller.

Available separately or in various integrated packages, our software supports IBM's SNA; X.25 packet networking; synchronous data link control (SDLC); high level data link control (HDLC) and many others.

So, when it's time to add more spice, flavor and color to your data communications get the whole enchilada, Viva Metacomp. You'll be glad you did!



\*Multibus is a trademark of Intel Corp.

## **Metacomp, Inc.**

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# Communications Controllers

AMD

AMTELCO

Bridge Communications, Inc.

Central Data Corporation

Codata Systems Corp.

Comark Corporation

Distributed Computer Systems

EMM/Sesco

ETI Micro

Excelan, Inc.

Frontier Technologies Corp.

Intel Corporation

Interlan, Inc.

Interphase Corporation

Metacomp, Inc.

Micro Digital, Inc.

Micro Industries

National Semiconductor Corp.

NEC Electronics U.S.A.

Procise Corporation

Proteon Associates, Inc.

Systech Corporation

3Com Corporation

The Destek Group

TITN, Inc.

Xicom Technologies Corp.



## SYSTEM-READY MULTIBUS<sup>™</sup> COMMUNICATIONS FROM ETI MICRO

### SAVES TIME ... SAVES MONEY

**W**e include sophisticated, user-proven, communication processing firmware as a standard feature on our multibus-compatible communication controllers, to cut your time to market and save precious dollars.

Our 8103 and 8140 controllers feature:

- two Bell modem ports and two RS232C ports
- controls up to 255 ETI Micro remotes
- communicates over twisted pair, leased phone lines or radio
- performs real-time multiple communication tasks
- interrupt-driven, communication processing firmware
- supports packet-switching protocol

- source codes listed for implementing custom protocols

Combine our 8183 (FCC approved) Direct Access Arrangement with the 8140 and get rotary auto-dial and auto-answer.

	Quantity: 1
<b>8103</b> Controller with two Bell 202 modems. Two RS232C ports	\$1,020
<b>8140</b> Controller with two modems. (Bell 103/202, CCITT V.21, V.23) Two RS232C ports	\$1,240
<b>8183</b> DAA Interface (FCC Part 68 Registered)	\$ 190
<b>8182</b> Lightning Protector, Transformer Coupled	\$ 111

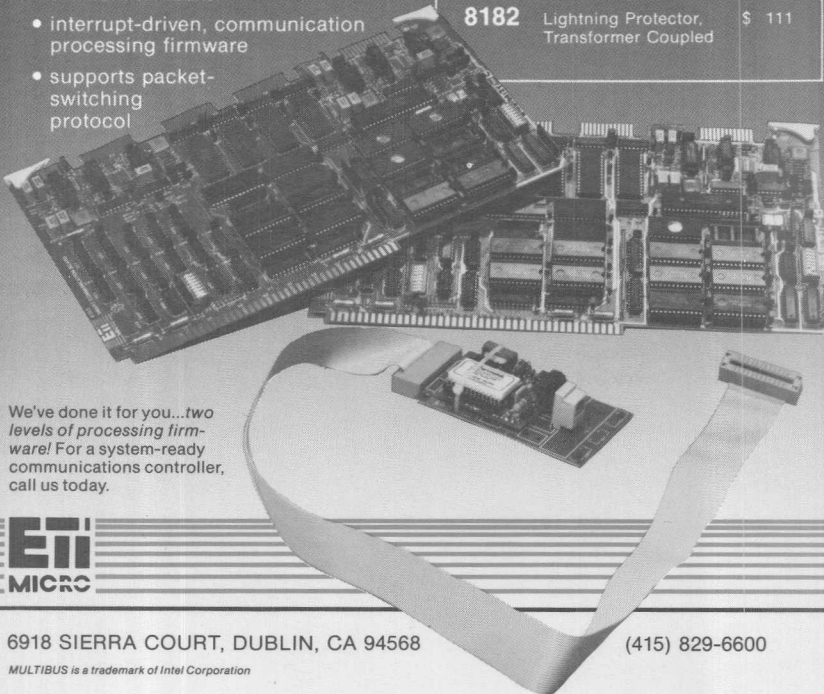
We've done it for you...two levels of processing firmware! For a system-ready communications controller, call us today.

**ETI**  
**MICRO**

6918 SIERRA COURT, DUBLIN, CA 94568

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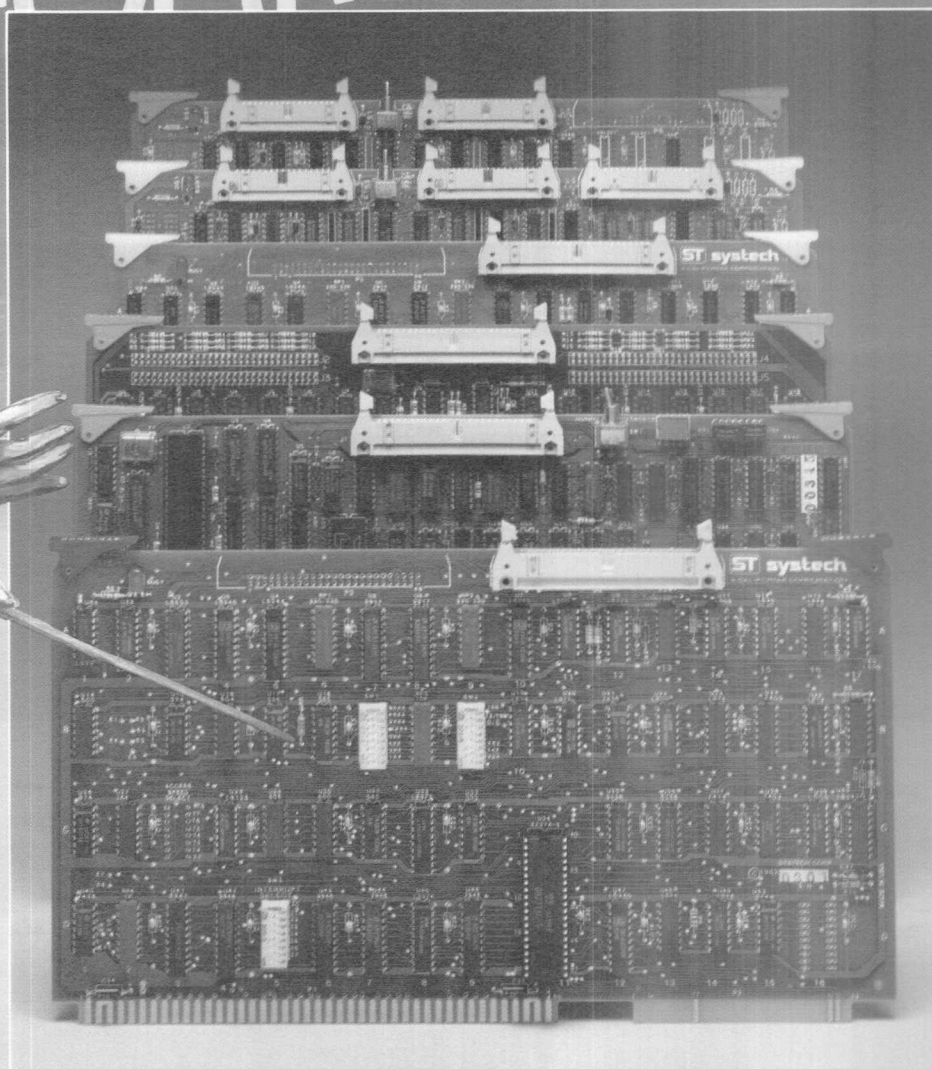




# COMMAND PERFORMANCE



FROM THESE  
POWERFUL  
MULTIBUS\*  
CONTROLLERS



- **STC-4400** QIC-02 Streamer Tape Controller
- **MTI-800/1600** DMA Communications Controller
- **HTC-4000** 1/2" Magnetic Tape Controller
- **VPC-2200** Versatec and Data Products/  
Centronics Printer Controller
- **MLP-2000** DMA Dual Printer Controller

UNIX\* Device Drivers provided to licensed users.



SYSTECH CORPORATION  
7630 Miramar Road  
San Diego, CA 92126  
619-695-3420  
TWX 310-499-0507 "SYSTC"  
Intl. ITT 499-0507 "SYSTC"

## The Multibus Leader

\*Multibus is a trademark of Intel Corp.

\*Unix is a trademark of Bell Labs.

# Communications Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
AMD ..... (408)988-7777	94/1530	\$ 395	6/83	stk	Dual Channel Serial Communications Controller
AMTEL CO ..... (608)221-3856	210A008	\$ 790	3/82	stk	16-Channel Serial RS-232 Communications Controller
Bridge Communications, Inc. .... (408)446-2981	SIO	\$1600	12/82	6wk	8-Channel Data Communications Controller
	EC/1	\$3000	12/82	8wk	Ethernet Controller High Performance
Central Data Corp. .... (217)359-8010	B1044	\$ 810	10/82	stk	Communications I/O Expansion
Codata Systems Corp. ....	SCC0800	\$2250	11/82	30da	Serial I/O Board
Comark Corporation ..... (617)359-8161	MS534	\$ 550	12/81	-	Communications Controller
Distributed Computer ..... (617)890-8200	DCS/SIO8	\$2800	★12/83	stk	Communications Controller
EMM/Sesco ..... SECS 80/534	SECS 80/534	\$4900	-	-	Communications Controller
	SECS 80/544	\$6000	-	-	Communications Controller
	SECS 80/1553	\$8500	-	-	MIL-1553 Communications Interface
ETI Micro ..... (415)829-6600	8103	\$1020	8/81	stk	Communications Controller
	8140	\$1240	83	stk	Communications Controller
Excelan ..... (408)945-9526	EXOS/101	\$1560	1/83	stk	Ethernet Front-End Processor
Frontier Technologies Corp. .... (414)964-8689	-	\$ 995	★12/83	-	Communications Controller

# Communications Controllers

## Distinguishing Features

On-board Z8530 SCC provides 2 independent serial ports (single width SBX module).....

Intelligent communications processor can be used in a multimaster or master/slave system or as a stand-alone processor.

Uses 10MHz 68000, RS-232/423/422 Interface, sync, async, SDLC Protocol capability, iSBX connector, 2 Five channel timers, modem controls, 8, 9600bps Full Duplex channels.

Uses 10MHz 68000, Large 128K Buffer for Back-to-Back Packets, implements Ethernet Version 1.0, Upgradable to IEEE 802 standard, serial port for down-loading, debugging, can run user protocol.

Eight EIA RS-232C channels, 2650 microprocessor controller, 16K dual-port RAM. Locking header connections for I/O. 4 Layer PCB construction. 2661 UART. 50-19.2K baud.

Eight serial I/O channels, on-board SCC handles sync, async, monosync, bisync, SDLC and HDLC/I/O handled by 4MHz Z80A uP w/64Kbytes of RAM.

Four channels RS-232C or opto-isolated 20mA current loop; auto-dial port; programmable baud rates; interrupt controller, 2-channel model.

Eight port serial I/O; intelligent communications controller with 8088 microprocessor; DMA and HDLC/SDLC; local network capability, 16K triported RAM, RS-232/422 to 1M baud.

Four fully programmable synchronous/asynchronous channels RS-232/422; MIL-Spec version of iSBC 534.

MIL-Spec. version of iSBC 544.

On-board 8085A; 2 RS-232C channels; 2 on-board Bell 202 modems; resident communications firmware; 8Kbytes dual-ported RAM; 16K/32K on-board RAM/EPROM.

Contains two RS-232C Ports, two modems, Bell 103/202, CCITT V.21, V.23; resident communications firmware, supports auto answer, auto rotary dial when used in conjunction with ETI Micro 8183 D.A.A. (FCC Part 68 registered).

EXOS/101 Ethernet<sup>C</sup> Front-End Processor -- Single Multibus<sup>C</sup> board with full Ethernet capability plus 16-bit 8088 processor, up to 128Kbytes of RAM, and NX/101 mini-operating system for running high-level protocol software supplied by OEM customers, Excelan, or third parties. Optional Model II w/128K RAM & 1795.

Async, bisync, HDLC/SDLC, protocol capabilities. DMA feature X.25 software in C 19.2KB rate. Full duplex, half duplex operation. Real-time clock and parallel port options. Switch selectable device addressing.

continued next page

# Communications Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
Intel Corporation ..... See Sales Office Listing	iSBC 550	\$2000	-	-	Ethernet Communications Controller IEEE 802 spec.
	iSBC 534	\$ 790	-	-	Four Channel Communications
	iSBC 544	\$1780	-	-	Communications Controller
	iSBC 88/45	\$1895	-	-	Advanced Communications Processor
	iSBX 352	\$ 395	-	-	Programmable Communications
Interlan, Inc. .... (617)692-3900	NI3010	\$1390	2/82	30da	Ethernet Communications Controller Version 1.0 spec.
Interphase Corporation ..... (214)350-9000	LNC5180	\$1995	9/82	-	Local Area Network Controller
	MOT5100	\$ 495	-	-	Media Access Unit (modern)
	LNC5181	\$1995	-	-	X.25 Gateway
Metacomp, Inc. .... (714)578-9840	MCS 1062	\$1960	12/81	stk	Communications Controller
	MPA 2000	\$2995	3/83	30da	Intelligent Serial & I/O
	MPX 2000-XXX	\$-	3/83	30da	Plug-in Modules for MPA 2000
Micro Digital Inc. .... (714)891-2363	BCB-300	\$ 990	6/81	30da	Programmable Communications Controller
Micro Industries ..... (614)895-0404	MIB 534	\$ 910	*8/83	-	Four Channel Communications Controller



# Communications Controllers

## Distinguishing Features

Provides data link and physical layer interconnection at 10 Mbit/sec data rate. On-board processor runs iNA950-1 transport software which offloads network intercommunication tasks from host.

Four fully programmable synchronous/asynchronous channels RS-232C or 20mA; 16-bit parallel I/O compatible with Bell 801 ACU; 16 maskable interrupt request lines.

On-board 8085A; 4 programmable synchronous/asynchronous channels RS-232C; 16Kbytes of dual-ported RAM; 10 programmable I/O lines-Bell 801 ACU.

Three HDLC/SDLC half or full duplex channels; optional: sync/async on 2 channels; DMA supports 800K baud operation, software.

HDLC/SDLC half/full duplex communications channel; point-to-point, multidrop, NRZI SDLC loop; RS-232C and RS-442A/449 interfaces; Programmable baud rates to 64K baud.

10 Mbits/sec data rate; data encoding and decoding.

Up to 255 Nodes/Network; 2 Mbit/sec data rate; HDLC/SDLC protocol; CRC-16 error detection; High speed DMA; 8-16 bit data bus; 24-bit address. Optional: LNC 5181 X.25 packet Network Controller.

75ohm coaxial transceiver, bus or star topology up to 3000 feet.  
Compatible with LNC 5180.

Supports X.25 both LAP and LAPB. Does all functions necessary to act as a stand along PAD. Geographically separated devices can be tied through public packet switching networks at data rates up to 56K baud.

Eight sync/async bit-sync channels with field interchangeable with RS-232C, RS-422/423 or current loop interface options. 8088 CPU with 96K EPROM, 128K RAM, 64K dual-ported, and interrupts. Hardware is iRMX-88 o.s. compatible. Software available. 24-bit address decode.

iAPX-186 CPU, 80130 OSF, 128K RAM with parity (64K dual-ported), 8 channels of on-board DMA. Low profile (non-SBX) plug-in modules available for various serial protocols, disk drives, parallel I/O. Can operate as Busmaster. MetaPaket architecture.

-110 4-channel I/O, async/sync/bisync, prog. baud rates; -120 2-channel DMA with async/bisync protocols; -130 2-channel DMA with SDLC protocols; -140 2-channel DMA with X.25 protocol; -210 16-bit full duplex I/O DMA interface between 2 Multibus systems; -310 disk controller.

On-board 8085. Four RS-232C channels. Four RS-366 auto-dialer channels. Binary messages up to 1500 bits. DMA with 20-bit address. 2K RAM. Up to 8K ROM. Designed for heavy dialing or binary data applications. (Soft UART).

Four RS-232C or optically isolated 20mA current loop buffered USART channels plus auto-call unit.

continued next page

# Communications Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
National Semiconductor ..... See Sales Office Listing	BLC-8545	\$1461	-	stk	Intelligent Communications Controller
	BLC-8538	\$ 890	-	stk	Eight Channel Communications Board
	BLC-8534	\$ 780	-	stk	Four Channel Communications Board
NEC Electronics ..... (617)655-8833	ADC0578	\$ 895	4/82	stk	Multi-Protocol Serial Controller
Procise Corporation ..... (206)392-0270	ARX-429	\$ 795	8/81	10wk	ARINC-429 Transceiver
Proteon Associates, Inc. .... (617)894-1980	HSBM/CTLM	\$3150	5/82	30da	Local Area Network Controller
Systech Corporation ..... (619)695-3420	MTI-800A	\$1895	12/82	stk	Eight Channel Serial Communications Controller
	MTI-800B	\$1895	★9/83	stk	Eight Channel Serial Communications Controller
	MTI-1600A	\$2395	12/82	stk	Sixteen Channel Serial Communications Controller
	MTI-1600B	\$2395	★9/83	stk	Sixteen Channel Communications Controller
3Com Corporation ..... (415)961-9602	3C 400	\$1250	5/82	45da	Ethernet Communications Controller Version 1.0 spec.
The Destek Group ..... (408)737-7211	NIB 100/2	\$1425	-	-	CSMA Management/Bit Stuffing HDLC/SDLC
TITN, Inc. .... (415)348-9181 (612)831-4422	TN/68/39	\$1000	81	6wk	Communications I/O Expansion
Xicom Technologies Corp. .... (613)238-4744 (415)924-1650	MicroNode	\$1500	★6/83	30da	SNA-Multibus Interface

## Distinguishing Features

Up to 4 channels of SDLC/HDLC/ADCCP or Bi-sync, half or full-duplex channels; Supports RS-232C CCITT V.24 or RS-422/449 serial interfaces. SDLC firmware supplied - on-board CPU.

Eight RS-232 sync/async channels; error detection for each channel; baud rates to 19.2K.

Model control and error detection; equivalent to iSBC 534.

Eight full-duplex; 4 DMA driven channels and 4 interrupt driven; sync/async. HDLC/SDLC; CCIT and X.25 protocols; 3.2M baud aggregate throughput; requires BPO 188.

Double wide SBX MULTIMODULE; 8-16-bit; 2 receive channels and 1 transmit channel.

10Mbit/sec data rate; token ring; twisted pair, coax or fiber optics; node-to-node separation 2km; full-duplex-host DMA interface; 255 nodes max; compatible with ISO; fail safe operation via PRONET wire center.

Intelligent DMA 8-channel serial I/O communications sub-system. Driven by sophisticated (factory supplied & supported) Time Division Multiplexing FIRMWARE. Asynchronous and Synchronous communications. Provides single character or block I/O commands. Contains extensive on-board self-test & diagnostics. See Ad, pg. #1  
Same as MTI-800A except configured as 2 board set. See Ad, pg. #1

Intelligent DMA 16-channel serial I/O communications sub-system. Driven by sophisticated (factory supplied & supported) Time Division Multiplexing FIRMWARE. Asynchronous and Synchronous communications. Provides single character or block I/O commands. Contains extensive on-board self-test & diagnostics. See Ad, pg. #1  
Same as MTI-1600A except configured as 2 board set. See Ad, pg. #1

Single board; address recognition of addr. supplied by PROM or software; dual-ported memory; 20-bit addressing; transmit delay 1 usec, receive delay 3 usec; software setting of selective interrupts and error handling by hardware; 10Mbit/sec.

On-board microprocessor, communications management firmware, bus I/O, buffers and a transceiver. Transmission speed of 2MB/sec.

Eight fully programmable RS-232C channels; 24 parallel I/O lines; 3 timers; 81T; opto-electronic isolators.  
Optional: V28 or TTL interface.

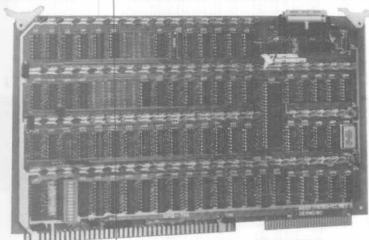
Requires Intel iSBC 88/45 communications processor board. Full SNA/SDLC type 2 Node Emulation.

# CHOOSE THE HIGH SPEED GPIB INTERFACE FOR MULTIBUS®

## MULTIBUS ↔ IEEE-488

ALL NATIONAL INSTRUMENTS INTERFACES HAVE COMPLETE TALKER, LISTENER, CONTROLLER CAPABILITY, AND COMPATIBILITY WITH IEEE-796 AND INTEL'S iSBX BUS STANDARDS.

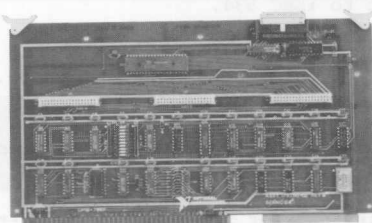
### DMA



**GPIB-796**

- DMA transfer rate of 500K bytes per second
- Direct DMA transfers to/from Multibus Memory
- DMA block-lengths up to 64K bytes
- 24-bit Memory Addressing
- On-board DMA test mode

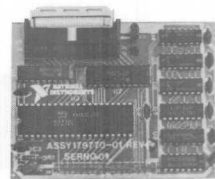
### NON-DMA



**GPIP-796P**

- Polled or interrupt-driven data transfers
- Selectable 8 or 16-bit I/O Port Addressing
- Optional: three iSBX connectors

### SBX



**GPIB-SBX**

- Compatible with Intel iSBX Bus
- DMA transfer rate of 250K bytes per second (with host DMA)
- Polled or interrupt-driven data transfers

® Multibus is a trademark of Intel

## SOFTWARE

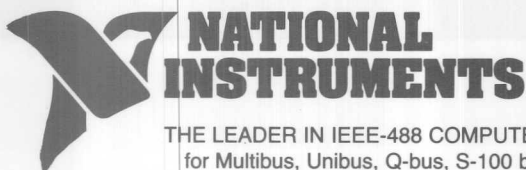
GPIB DRIVER AND OPERATING SYSTEM HANDLER SUPPORT FOR  
UNIX • UNIX LOOK-ALIKES • CP/M • MS DOS • APOLLO AEGIS • INTEL RMX

Low and High-Level GPIB Functions callable from application programs written in BASIC, Pascal, FORTRAN, C, or Macro Assembly languages

Application support available through our customer hotline

Interactive Control program facilitates rapid software development and system trouble-shooting

User Technical Manual with example software provided



THE LEADER IN IEEE-488 COMPUTER INTERFACES  
for Multibus, Unibus, Q-bus, S-100 bus, STD bus, VME bus, DEC bus, DEC Rainbow 100, and IBM-PC computers  
12109 TECHNOLOGY BOULEVARD, AUSTIN TX 78727 (512)250-9119 (800)531-5066 outside Texas



# IEEE 488 (GPIB) Controllers

Densan Co., Ltd.  
Distributed Computer Systems  
Frontier Technologies Corp.  
Industrial Micro Applications, Inc.  
Information Development  
Intel Corporation  
National Instruments  
National Semiconductor Corp.  
Relms  
Zendex Corporation  
Ziatech Corporation

# IEEE 488 (GPIB) Controllers

Manufacturer	Model	Price	DFA	Deliv.	Data Rates (Kbytes/sec)		Compliance IEEE 796 Bus	Compatibility
					Prog. I/O	DMA		
Densan .....	DSB-581	\$-	-	-	-	-	-	-
Distributed Computer .....	DCS/488	\$ 750	81	stk	-	250	-	DCS/86 ICM/86
(617)890-8200								
Frontier Technologies Corp. ....	-	\$ 695	*10/83	-	-	-	-	-
(414)964-8689								
Industrial Micro Applications Inc...	IMA 488	\$1200	2/82	stk	-	-	-	SBC86/88
(713)488-1171								
Information Development .....	HS-488	\$ 895	80	-	40	-	-	-
Intel Corporation .....	iSBX 488	\$ 650	-	-	50	300	-	-
See Sales Office Listing								
National Instruments .....	GPIB-796	\$1295	2/83	stk	30	300-500	M:D8M24	S:D8I16VO
(800)531-5066								
	GPIB-796P	\$ 650	3/83	stk	30	-	-	S:D8I16VO
	GPIB-SBX	\$ 450	4/83	stk	30	-	-	S:D8I16VO
National Semiconductor .....	BLC-8488	\$ 700	-	stk	256	125	-	-
See Sales Office Listing								
Relms .....	rMEM-CLB	\$-	-	-	-	-	DB M24	-
Zendex .....	ZBX-488	\$ 500	-	stk	-	-	-	-
(415)828-3000								
Ziatech Corporation .....	ZT85/18	\$ 595	5/82	stk 6wk	30	N/A	D16M20I16VO	SBC 80/XX,MDS 80
(805)541-0488								
	ZT80	\$ 995	6/77	stk 6wk	N/A	6.5	D8M16VO	SBC 80/XX,MDS 80
	ZT85/38	\$1200	7/80	stk 6wk	30	250	D16M20I16VO	SBC 80/XX,MDS 80
	ZSBX20	\$ 450	9/82	stk	30	300- 500	-	-

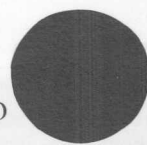
Talker/Listener	Data Bus (bits)	Address (bits)	Distinguishing Features
o/o	-	-	Includes two serial interfaces RS-232C or 20mA.
o/o	8	20	Utilizes Intel 8291, 8292, 8293 with DMA capability.
o/o	5,6,7,8	-	Optional EPROM/PROM burner. Optional serial port and real-time clock, \$100 ea.
o/o	8/16	20	I/O driver compatible with Intel iRMX86 and iRMX88 Basic I/O subsystems.
o/o	8/16	16/20	+5V only.
o/o	8/16	16/20	Multimodule, +5V only, complete 488 talker/listener/controller implementation.
o/o	8/-	16/20/24	Full function GPIB Controller, Talker, Listener; 24-bit DMA addressing; 500Kbytes/sec max transfer rate; sample software routines, without memory boundaries.
o/o	8/-	8/16	Full function GPIB Controller, Talker, Listener; optional circuitry and connectors for 3 Intel type SBX piggyback boards for multi-function capability; sample software routines.
o/o	8/-	8/16	Full function GPIB Controller, Talker, Listener; sample software routines; Intel type SBX piggyback card.
o/o	8/16	16/20	Z80A based; All GPIB firmware included, expandable to 16 controllers.
o/o	-	-	Two serial ports; up to 64Kbytes of EPROM.
-/-	-	-	Uses T.I. TMS-9914 GPIB controller SBX MULTIMODULE.
o/o	8/16	20	Most inexpensive GPIB/MULTIBUS controller available; same as ZT85/38 but without DMA. Complete with software drivers; 66 page manual, cable and application examples.
o/o	8/16	16	Least overhead of Ziotech's controllers; on-board processor relieves system CPU of all overhead during data transfers. Complete with software drivers, 85 page manual, cable and application examples.
o/o	8/16	20	Highest speed interface that has its own on-board DMA; no DMA support required from system CPU board. Complete with software drivers, 74 page manual, cable and application examples.
o/o	8/-	-	Full function GPIB Controller. Talker/Listener on "Piggyback" Multi-mode board. Device drivers and example application software provided. Cable and manual included.

# WE LIKE IT THAT YOU LIKE IT

Nothing makes a company feel better than developing a popular product. But acceptance of the iRMX 86 Operating System has been nothing short of spectacular.

Today, it is the industry standard. Independent software vendors are using it to plug into VLSI technology, and to design in their own high performance features. And OEM's are using it to tap rapidly expanding mass market application software. In many popular languages.

They tell us it's because it has five times the multi-tasking talents of any other operating sys-



tem. And because it supports multi-processing, and is the only operating system taking full advantage of VLSI — already putting its advanced architectural virtues into silicon. And they're all raving about the cost advantages.

Frankly, we're flattered. So here's to you . . . the 868 vendors out there using our system.

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Hillsboro, Oregon 97123  
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# The Multibus<sup>®</sup> Buyers Guide

## **Multibus<sup>®</sup> Market: Its Origin and Evolution**

The Multibus market is a relatively new phenomenon, but its roots can be traced back to the formative years of the microcomputer industry. Its history is one of humble beginnings and gradual, controlled evolution. An understanding of this history is useful in understanding the market.

In the early 1970's, the advent of VLSI component technology offered revolutionary benefits to the awaiting public. The emergence of these new "super chips" created opportunities and chaos in the marketplace, while competitive pressures forced companies to invest in the new concept. Everyone had to participate to be competitive, but not everyone had the design expertise.

Intel Corporation, being aware of the situation, introduced its Intellect<sup>™</sup> series of development systems to provide design engineers with the software development tools needed to implement system designs. This software assist was welcomed, however, customers also wanted to reduce the hardware design effort. Consequently, they purchased development system units, removed the boards for incorporation into their own boxes, and used the development system bus as the interface. They wanted the capability of designing their own custom boards, so a copy of the system bus specifications were requested. Intel then began distribution of the system bus specifications to the world.

Intel recognized the need for board level solution, and pursued it. In 1976, they introduced their first board-level computer, the iSBC<sup>™</sup> 80/10, integrating a CPU, memory and I/O on to the first OEM single board computer. Soon after, the development system bus was given its own name, the Multibus system bus, and the Multibus market was born.

The new single board computers became an instant success, and an array of compatible products emerged from Intel and other vendors as well. Then in 1977-78, the microcomputer industry witnessed the introduction of new VLSI microcomputers. These new 16-bit machines had a new demanding set of requirements. With a downward compatible evolution, the Multibus structure supported these new processors, and reaffirmed the viability of the Multibus system bus as a long-lined industry standard.

Some of the characteristics which are required of a standard should be known before examining its advantages. The three most important requirements are:

- A standard must have industry acceptance and support.
- A standard must evolve to meet the needs of the future.
- A standard must have a single point of control.

In the case of the Multibus system bus standard, it was introduced in 1976,

*(continued on page 114)*

iSBC, iSBX, Multibus, MultiChannel and Intellect are trademarks of Intel Corporation.

# The Multibus<sup>®</sup> Buyers Guide

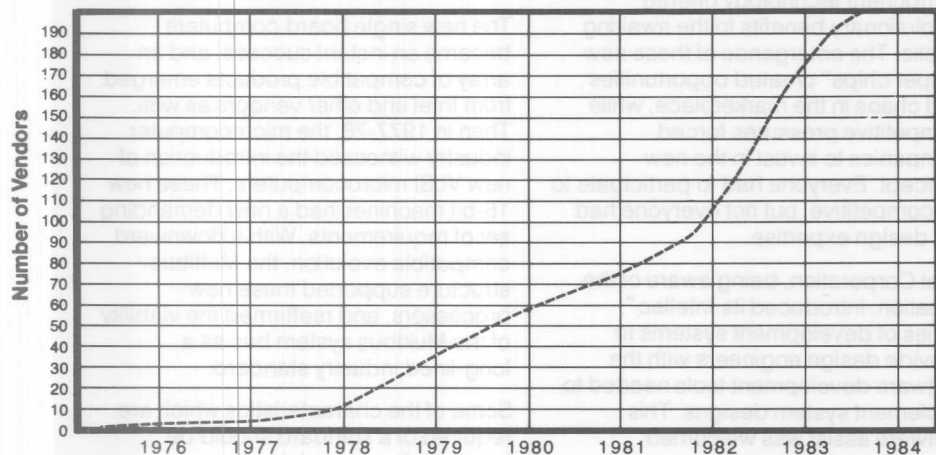
(continued from page 113)

and in two years had achieved wide spread industry acceptance. The bus had evolved to accommodate both 8 and 16-bit machines and their requirements. At first, Intel maintained control of the bus specifications, but now this task has been assumed by the IEEE. This single point of control

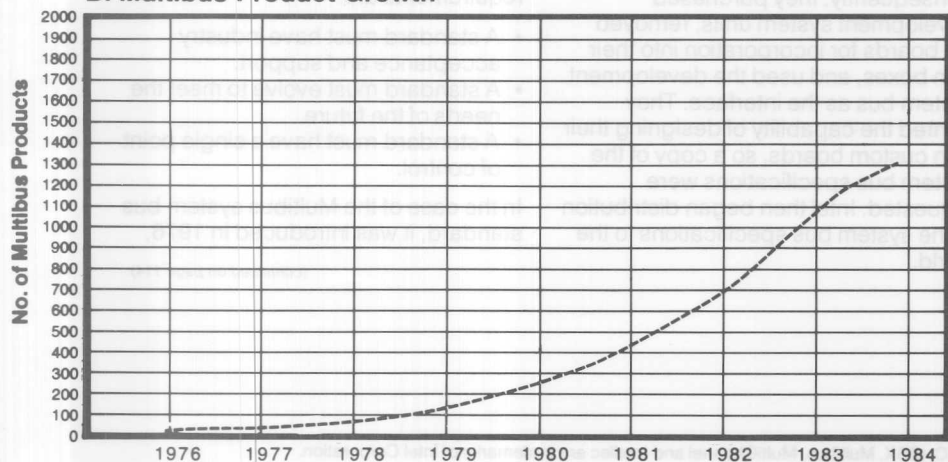
ensures product compatibility between different board sources. Multibus specifications were freely available to the industry and were in the public domain. It was for these reasons that Multibus architecture became the defacto industry standard, and also the IEEE bus standard, IEEE 796.

(continued on page 115)

## A. Multibus Vendor Growth



## B. Multibus Product Growth



# The Multibus<sup>®</sup> Buyers Guide

The advantages that the Multibus architecture standard offers to the user are based on growing support by multiple sources and continued evolution. The Multibus market has shown phenomenal growth in the number of Multibus vendors. Another area of tremendous growth in the Multibus market is in the number of Multibus products made available to the industry by the growing Multibus vendor base. Together, the Multibus vendor and product growth trends reveal a healthy market.

A healthy open market offers tremendous benefits to potential users of Multibus products. For instance, 200 Multibus vendors means competition, and competition encourages competitive, low prices. The user pays less per Multibus product and reduces overall system unit cost. Multiple sources of Multibus products also means reduced risk to the user by eliminating the threat of sole source supply of important parts. Also, an open market which offers over 1200 Multibus products provides a user with a wider range of choices. This selection of system solutions offers system designers almost unlimited flexibility and freedom. These pre-tested, off-the-shelf units mean a user can get to market quicker, with lower costs, and yet have the latest in VLSI technology. Additionally, a Multibus user can optimize his own resources and expertise, by concentrating on what he does best, and designing his own proprietary boards to the Multibus *standard*. This allows the user to inject as much added-value into the system as he can in order to maximize his profit and be competitive. Only adherence to the Multibus standard allows this flexible, added value concept to work.

(continued on page 116)

# Multibus<sup>®</sup> Buyers Guide

(continued from page 115)

In order to maintain adherence to a standard, the standard must continue to evolve to meet the needs of the future. Since the Multibus markets needs are dynamic, the standard cannot remain static. It must be adaptable and upgradable; continuing to evolve in a controlled deliberate manner.

The Multibus standard actually evolved in two different ways: the structure and the architecture. The structure evolved from 8-bit to 16-bit capability, and direct addressing expanded from 64 KB to 16 MB. The architecture was expanded via the iSBX™ bus and the MultiChannel™ bus. These evolutionary expansions were necessary because a single system bus structure was no longer capable of supporting the demands of today's high-speed, high-performance VLSI microprocessor technology, and its increasingly complex configurations. A single bus structure also tended to limit the available products to one dimensional "solutions".

The Multibus architectural extensions occurred in the evolutionary process, because of the potential advantages in improved performance and flexibility.

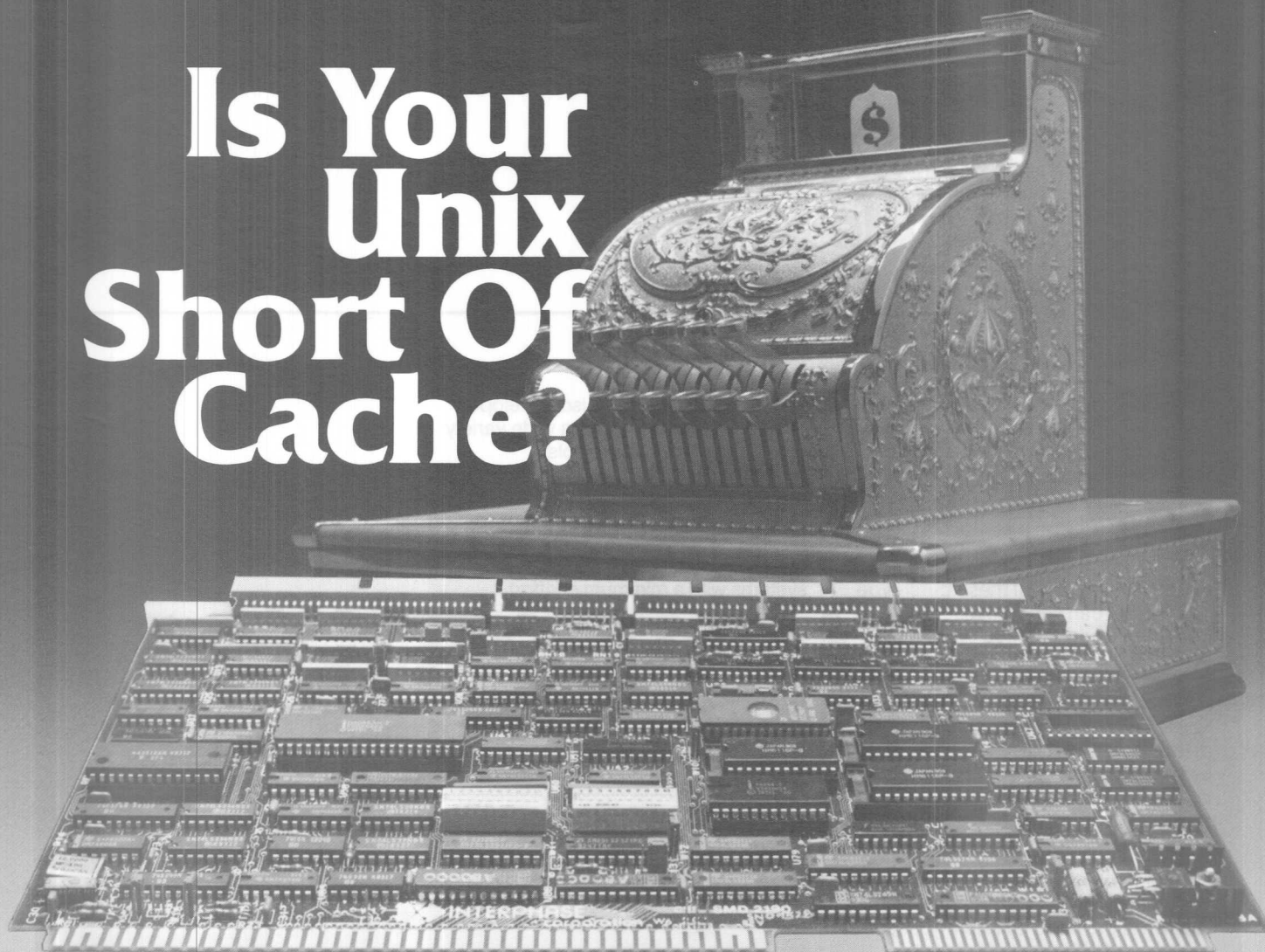
The iSBX bus was created to provide users with a low cost, on-board expansion solution for Multibus single board computers. Currently, the iSBX boards allow users to add capability to a single board computer in the areas of parallel I/O, serial I/O, peripheral

controllers, and high-speed math; without going to the expense of adding another full Multibus board. The iSBX bus compatible boards enable users to buy exactly the capabilities they require for their Multibus based systems, which keeps both system size and system cost at a minimum.

(continued on page 118)



# Is Your Unix Short Of Cache?



## Presenting the first UNIX<sup>™</sup> optimized SMD disk controller for Multibus.<sup>™</sup> Available today from INTERPHASE.

The SMD 2190 is the first high performance disk controller optimized for UNIX and UNIX-like operating systems. Its highly intelligent caching scheme gives you the flexibility to match your disk controller to your operating system. This means optimum performance for all versions of UNIX.

With the SMD 2190, you get high speed cache memory plus all the features you've come to expect from a high performance disk controller.

1:1 Interleave, 20 Mb/S data rate, 32-bit ECC, Automatic Error Correction, Bad Track and Sector Mapping, and Overlapped Seeks for high performance on the disk side.

Ultra-high speed DMA, 8- and 16-bit data transfers, and both Relative and Absolute 24-bit addressing for high performance on the Multibus side.

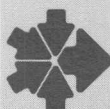
Easy to use MACRO-level Commands — READ, WRITE, FORMAT — mean simple software drivers.

Most-Primitive Error diagnostic reporting and a low parts count mean minimum integration time and high reliability.

Software compatibility across the Interphase Family of SMD disk controllers means the maximum return on your software investment.

You've come to expect high quality innovations from Interphase ... the most talented intelligent disk controller specialists in the country. And the SMD 2190 is no exception. It is elegant, well designed, affordable and available off the shelf.

But that's not all. We give you full support to help you integrate the SMD 2190 into your system. And we'll even leave some change in your pocket. Call or write us today.

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# The Multibus<sup>®</sup> Buyers Guide

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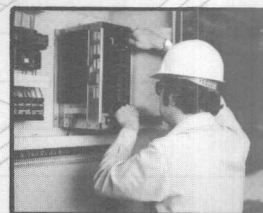
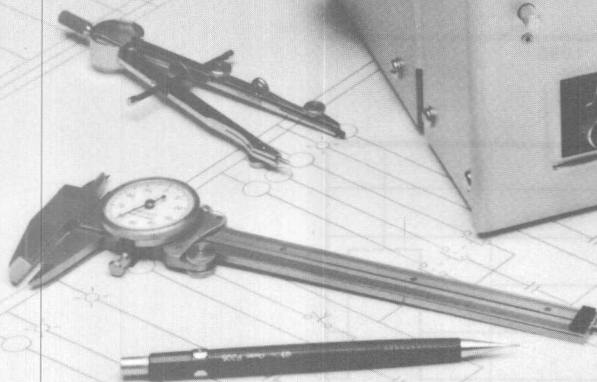
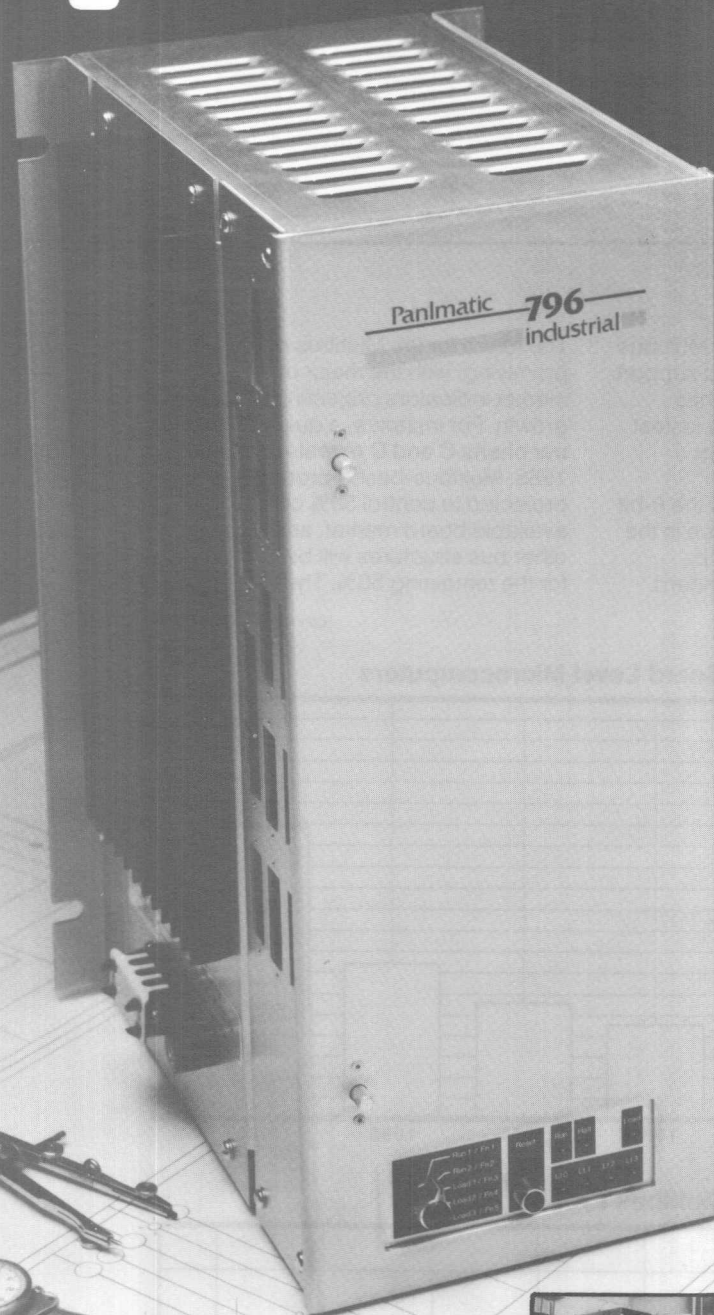
The MultiChannel bus was created to provide users with a separate path for DMA I/O block transfers. The ability of new VLSI microprocessors to process data at very high rates necessitates the connection of numerous high-speed I/O devices to the system bus. The major problem with this approach is that the attachment of these burst-type peripherals can saturate a general purpose bus and reduce the computing performance of the system. The MultiChannel bus was designed to eliminate this problem by providing for high speed (8 MB/sec) block transfers of data over an 8/16-bit wide data path between peripherals and single board computer resources.

Another evolutionary development of the Multibus standard is the continued development of support from all Multibus vendors. The hardware support is provided by primary, second source, and aftermarket suppliers offering a wide selection of products. Since the Multibus architecture is CPU independent, most of the industry's microcomputer components have been interfaced to the Multibus standard. This encourages the industry leaders to supply a continuous flow of VLSI technology to the Multibus board-level market. This broad base of silicon and board-level support, provides the user multiple levels of hardware integration for incorporation into his system.

Technical support has also developed over time, and now offers a wide variety of development/debug tools, documentation, and training for users of Multibus-based systems. These technical tools provide the means to design, debug, and implement microcomputer software and hardware systems with a minimum of effort.

(continued on page 120)

# Designed for Industry



Introducing the Panlmatic 796 Industrial™... an affordable four slot Multibus chassis with features that used to cost extra:

- Modular 130 watt switching power supply on a removable chassis
- Adjustable power fail detection
- Front panel interface and controls through a field selectable I/O port
- Removable punched I/O panel with space for both D and ribbon connectors.
- Accommodation for iSBX boards
- Card access through a hinged, power interlocked front door
- Rugged aluminum enclosure 11 1/2" deep for NEMA pan mounting

Real time clock and other options are available. Write or call for pricing, options and customizing services.

**Panlmatic**

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# The Multibus<sup>®</sup> Buyers Guide

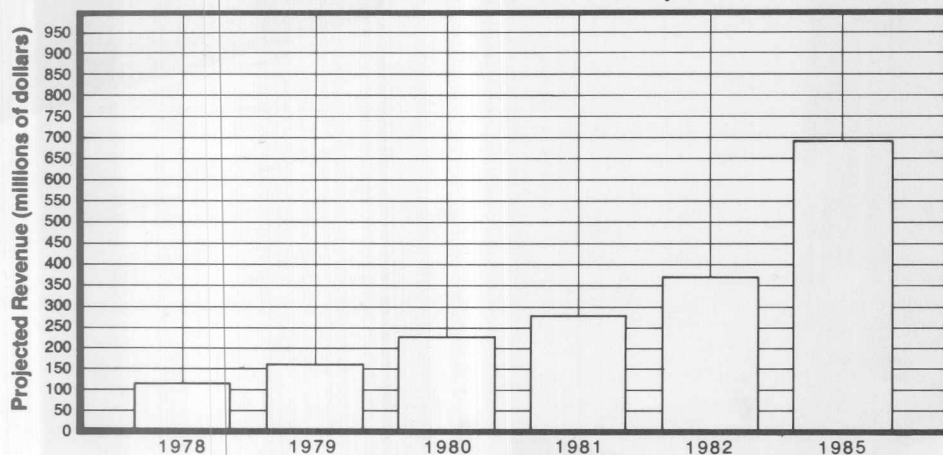
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The continued evolution of the Multibus standard, along with continued support and adherence by the market has made the Multibus solution the fastest growing microcomputer system architecture in the board level marketplace. Its dominance of the 8-bit market and its growing influence in the 16-bit market is an example of its success as a true industry standard.

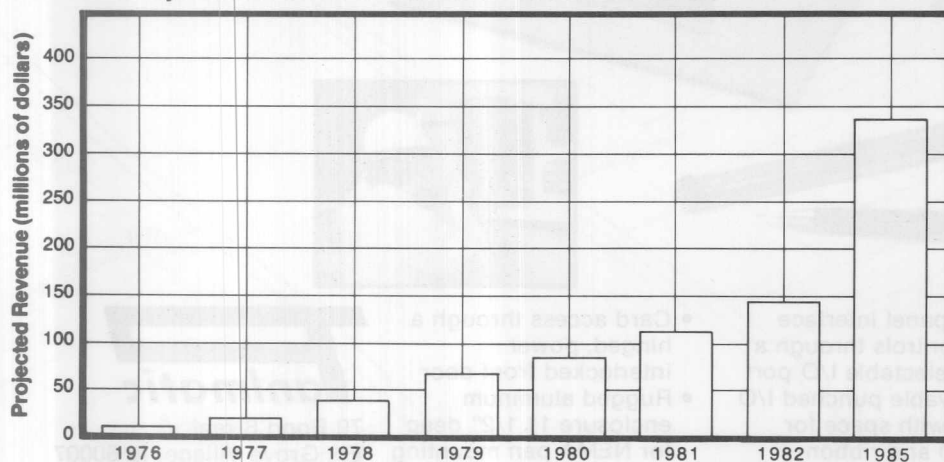
The future for the Multibus market looks promising, with the major overall market indicators projecting continued growth. For instance, a quick glance at bar charts C and D reveals that: 1) in 1985, Multibus-based products are projected to control 50% of the total available board market, and 2) over six other bus structures will be competing for the remaining 50%. The trend

(continued on page 121)

## C. Available Market for Board Level Microcomputers



## D. Projected Growth of Multibus Product Revenue

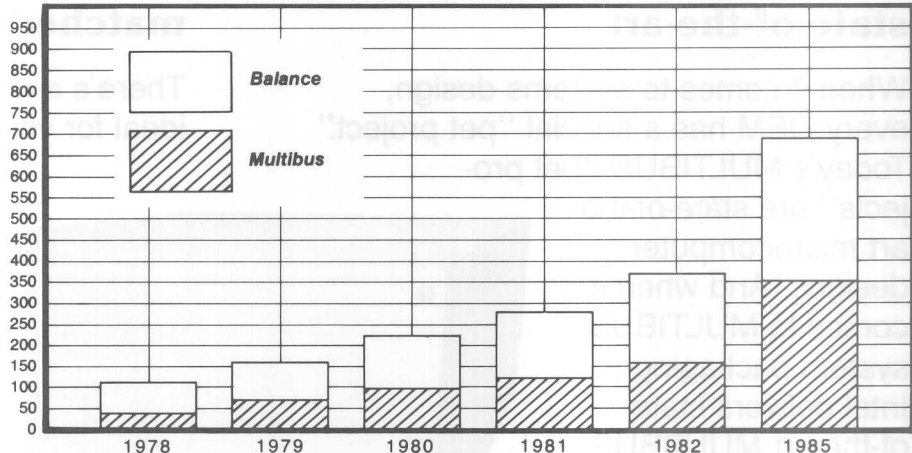




# The Multibus® Buyers Guide

(continued from page 120)

## E. Comparison of Total Available Market/Multibus Share



seems to be clear, the Multibus market will continue to develop and become the predominant segment in the board-level market. This trend is supported by other evidence. For instance, the number of Multibus vendors has increased from approximately 10 to over 120 in just 5 years, with a projection of close to 240 vendors by 1984. (See Graph A, page 114.)

Another indicator which supports the continued Multibus market trend is the projection of Multibus product growth. For example, the curve on Graph B shows the growth of Multibus products

rising to a projected 2,000 available products by 1985. What all of this data is saying is that the Multibus market is growing rapidly, and this growth will continue to capture market share from industry competitors.

The user will continue to see significant growth in the Multibus vendor base and the products which they support. This data portrays the Multibus standard as a thriving, evolving, dynamic architecture supporting a market which is as "alive" today as it was in the past. The future seems bright for the Multibus market. It's come a long way in six years, and it will go a lot farther. ■

# THE CARE AND FEEDING OF YOUR MULTIBUS® PRODUCTS

## Your pet project deserves state-of-the-art

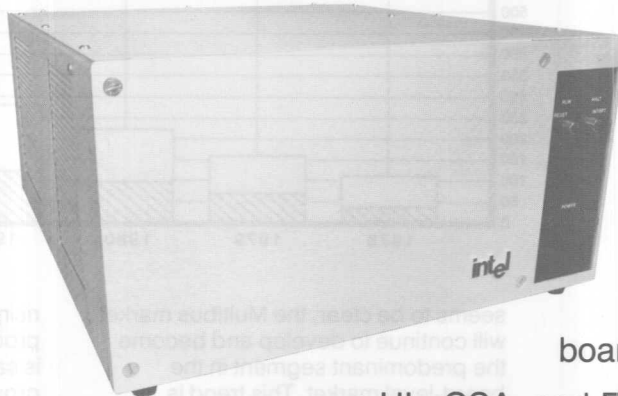
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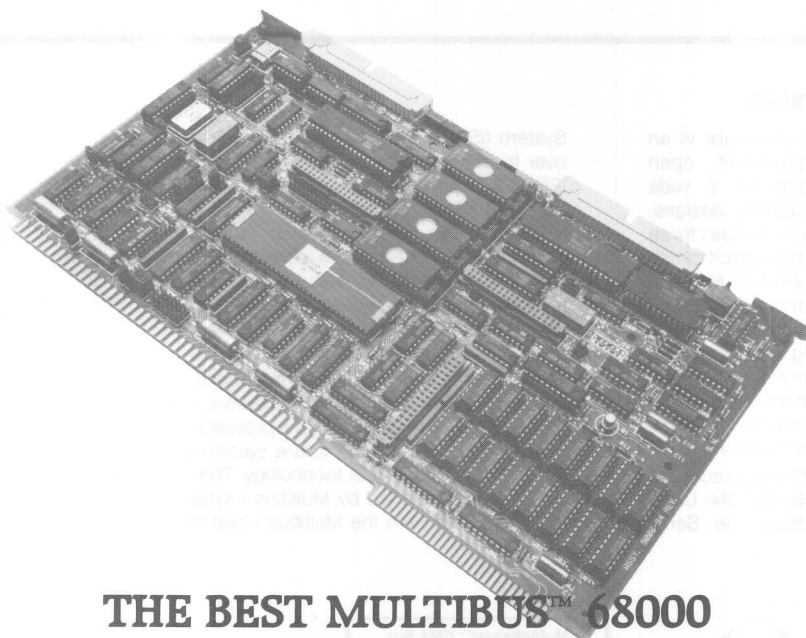
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# Introduction To The Multibus® II System Architecture

## Architecture Overview

The Multibus II System Architecture is an advanced, processor-independent, open system architecture suitable for a wide range of microprocessor-based designs. The multiple bus architecture includes three bus structures defined in this specification and compatibility with two existing Multibus I/O buses. Multibus II systems offer designers significant performance advantages and advanced features including a 32-bit parallel system bus with 40M byte/sec throughput, high-speed access to large amounts of off-board memory, a low-cost serial system bus, and effective multiprocessor support.

The Multibus II System Architecture consists of the Parallel System (iPSB) Bus, the Local Bus Extension (iLBX II Bus), the Serial

System (iSSB) Bus, and two buses carried over from the Multibus I architecture — the iSBX I/O Expansion Bus and the Multichannel DMA (Direct Memory Access) I/O Bus (Figure 1). A common system interface and data transfer protocols ties the buses together and allows designers to choose from several combinations of the five to meet specific application requirements.

Because of its multiple bus structure and its ability to support 32-bit microprocessors, the Multibus II system architecture provides an evolutionary path to both future system expansion and future VLSI technology. The architectures supported by Multibus I system have migrated from the Multibus I system.

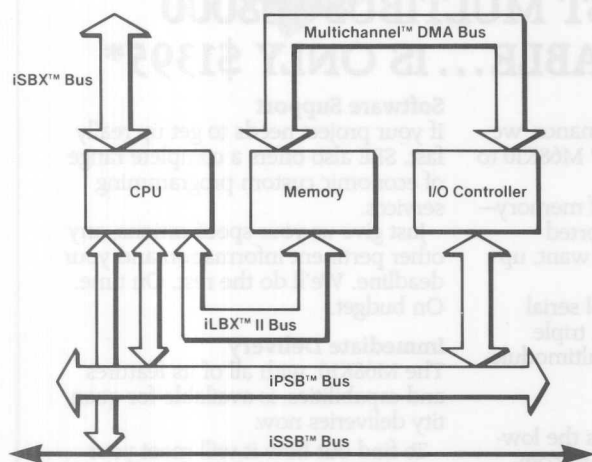


Figure 1. MULTIBUS® II System Architecture (5 Buses)

## An Answer to Obsolescence

In the last decade, the avalanche of new microcomputer technology, especially VLSI, threatened to obsolete products almost before they went into production. To buffer user's from this onrush of technology, Intel helped develop standard interfaces. One of the most notable was the Multibus I System Architecture.

Multibus I became not only the industry standard, but it was designated the IEEE 796

standard as well. With the Multibus I interface, user's could exploit the benefits of VLSI technology without having to pay a premium for new system design.

Other benefits from the use of standard interfaces in the Multibus I architecture soon followed. As Intel's "Open Systems" design strategy gained wide acceptance, after-market support grew, providing multiple supply sources, wide product selections and



# Introduction To The Multibus® II System Architecture

competitive prices. Today, 200 companies manufacture over 1,000 Multibus I compatible products.

The Open Systems approach was also demonstrated in Intel products which provide compatible products at three levels of integration: components, boards, and systems. This multilevel approach has enabled OEMs to adapt to new business environ-

ments and opportunities as VLSI technology expanded.

Standard interfaces for hardware and software combined with many Multibus products (from both Intel and aftermarket suppliers) made it possible to configure new systems having unique requirements with minimal risk and investment.

## Multiple Bus Structures

Microcomputer systems require many types of data movement: memory-to-CPU for instructions and data; CPU-to-CPU for interrupts and messages; I/O-to-memory for high speed data transfer; and CPU-to-I/O for direct control of I/O. In most systems, one general purpose bus can do all these three functions. However, for high performance systems, a general purpose bus lacks the total bandwidth required. And, in low-cost systems, the general purpose bus may be too costly.

A multiple bus structure provides specialized buses for specific critical functions. Four important advantages result.

1. The bandwidth of the general purpose bus is preserved, creating a "virtual bandwidth" for interprocessor communication and data movement.
2. The specialized bus does its function better than a general purpose bus.
3. Functions can be carried out in parallel on different buses.
4. Users can tailor their system performance and avoid unnecessary costs by selecting only those buses required for their application.

While the Multibus I interface pioneered the multiple bus approach, the Multibus II system architecture refines it and extends its range. The new architecture offers five processor-independent buses which give system designers the ability to configure their systems for their needs today as well as meeting the future system requirements.

Each of the Multibus II interfaces is fully compatible with the others. Thus, in general, it is simply a matter of choosing the appropriate bus or combination of buses to fit the exact needs of a particular application. Moreover, the standard interfaces mean designers can reconfigure the system as new requirements demand — or as VLSI technology provides improvements in microprocessor technology.

Multibus I users can upgrade to the Multibus II architecture as their needs expand to 32-bit capabilities, or as their 16-bit systems begin to require more sophisticated multiprocessing capability. Therefore, new users requiring high performance 16- or 32-bit data paths optimized for multiprocessing will find the multiple bus structure of the Multibus II System Architecture ideal for advanced microprocessor design.

## Multiple Bus Structures Enhance Functional Partitioning

Each multiple bus structure is tailored for a particular purpose. This is part of a design philosophy called "Functional Partitioning." Basically, functional partitioning is a modular design approach that requires breaking an overall problem into manageable pieces based on function. For example, typical microcomputer system functions are mass storage control, data processing, communications and graphics.

In typical functionally partitioned systems, data movement between modules is mini-

mized. Requests for data movement are kept to a minimum, and critical real-time data should be kept in the local environment. Once the modules have been defined, they are implemented by optimizing each for its specific requirement. The Multibus II System Architecture defines standard interfaces between each functional module and tailors each interface to its specific function.

For example, the Parallel System Bus (PSB bus) is optimized for interprocessor communication and data movement. The Local

# Introduction To The Multibus® II System Architecture

Bus Extension, (iLBX II bus) is similarly optimized for very high speed execution. And the Serial System Bus (iSSB bus) is optimized for low-cost interprocessor communication.

Thus, the Multibus II System Architecture

## The Multibus® II Bus

The Multibus II System Architecture consists of the Parallel System Bus, the Local Bus Extension, the Serial System Bus, and two buses carried over from the Multibus I archi-

## Parallel System Bus (iPSB™ Bus)

The Multibus II Parallel System Bus is a high-performance, general purpose bus that provides important data movement and interprocessor communication functions. Being general purpose in nature, the iPSB bus also supports arbitration, execution and I/O data movement and board configuration support.

The iPSB bus supports four address spaces: a 32-bit wide memory address space, a 16-bit I/O address space, a 16- or 32-bit message address space, and a 16-bit intercon-

### High Performance

The Parallel System Bus has a burst transfer capability yielding a maximum sustained bandwidth of 40 megabytes/second. The burst is implemented as a single address cycle followed by multiple data transfers which maximize the bus bandwidth.

### Multiprocessor Support

Message Passing is another important attribute of the Parallel System Bus. This feature allows two bus agents (i.e., boards) to exchange information in blocks of data. The iPSB bus method of message passing provides a high performance facility for moving data from one functional module to another without having to worry about memory management or synchronization problems at the bus interface.

The iPSB bus supports multiple master processor agents. That is, the arbitration features can support up to 20 requests for the bus at the same time. This supports the functional partitioning approach and maximizes the effectiveness of each function.

provides the means to design a system optimized for performance with each bus serving a specialized function. Since each bus is also optimized for performance, functional partitioning of the modules is supported and enhanced.

ture — the iSBX I/O Expansion Bus and the Multichannel DMA (Direct Memory Access) I/O Bus.

nect address space. Data is clocked at 10 MHz and can be up to 32-bits wide.

In addition, the iPSB bus incorporates features which:

- Provide high-performance data movement
- Enhance multiprocessor support
- Improve ease-of-use
- Increase system reliability

The following is a brief discussion of those features.

### Ease of Use

The iPSB bus is a processor-independent general purpose system bus. As such, it supports 8-, 16-, and 32-bit processors, and is capable of transferring 8, 16, 24, or 32 bits of data. This attribute makes it extremely flexible.

General system-wide functions such as power-up/power-fail, bus time-out, system timing references, time-of-day clock, etc. are centralized into one function called the Central Services Module. In multiple agent systems, centralization of such functions reduces system cost, frees board area for other functions and is generally more efficient. The Central Services Module can be located on a unique board dedicated to that function or on any board in the system.

The Interconnect Address Space is provided for dynamic configuration of Multibus II boards. This feature allows board options to be programmed or read from interconnect space which simplifies the configuration task and allows system resources to be identified. It also allows system-level diagnostics to access the results of board-level diagnostics for system confidence reports.

# Introduction To The Multibus® II System Architecture

## Reliability

Since the Parallel System Bus is synchronous, the signals only have to be valid at specific intervals. Thus, noise-induced signals are not likely to be erroneously interpreted as data or control.

Reliability is also enhanced by such features as parity on transfers, DIN connectors and distributed ground pins. Byte parity is checked and generated for address, data and command lines. The pin and socket design of DIN connectors makes them extremely reliable. Also, the isolation of critical signals with adjacent

ground pins reduces noise in nearby circuits on the backplane.

In summary, the Parallel System Bus is a full-functioning, general purpose system bus which enhances multiprocessor support by its unique message passing facility. It improves ease-of-use through its multiple data width and interconnect facilities. Finally, the iPSB bus increases system reliability by virtue of its synchronous nature, its parity on transfers, and its two-piece DIN connectors.

## Local Bus Extension (iLBX™II)

Multiple CPUs executing instructions in shared global memory can easily saturate the system bus, resulting in overall system performance degradation. An extension of the on-board processor bus provides the means to remove the processor execution functions from the general purpose system bus and extend local on-board processor bus provides the means to remove the processor execution functions from the general purpose system bus and extend local on-board performance capability to off-board memory resources.

The iLBX II Bus helps to maximize performance in Multibus II systems by providing arbitration-free local memory expansion to 64 megabytes and a maximum bus clock rate of 12 MHz. It is a processor-independent bus that supports 8-, 16-, and 32-bit processors and up to six agents or boards.

The iLBX II Bus provides an alternate very high bandwidth path (48 megabyte/sec) to the processor's memory resources. In doing so, it reduces the processors' system bus bandwidth requirements by 60%-90%. Since it has been optimized for execution, it does not provide the functions of I/O or message passing.

A synchronous bus providing increased reliability, the iLBX II bus incorporates a number of advanced features which enhance system performance. For example, the iLBX II bus allows pipelining; the ability for the address portion of the following cycle to overlap on the data portion of the current cycle. Pipelining promotes the efficient use of the execution bus and helps make possible its higher bandwidth.

Another contributing factor to the higher bandwidth on the iLBX II bus is its ability to support block transfers. With one address phase, the bus can obtain multiple pieces of data, again a more efficient use of the execution bus.

As with the iLBX bus in the Multibus I architecture, more than one iLBX II bus may exist in a Multibus II system to optimize each processor's performance.

The iLBX II bus, then, is a high-speed, high-bandwidth execution bus which extends the on-board local bus to off-board memory resources. Its 48 megabytes/sec bandwidth, bus clock rate of 12MHz and advanced features like pipelining and block transfers make it a high performance, low latency, reliable bus for today's multiprocessor architectures.

## Serial System Bus (iSB™)

The Serial System Bus is very closely tied to some characteristics of the Parallel System Bus since it implements the message passing functions of the iPSB bus with a low-cost serial interconnect. That is, the iSSB bus is a low-cost alternative to the message interface on the iPSB bus.

Whereas the iPSB bus 32-bit wide parallel transfers and runs at 10 MHz. Thus, the performance is roughly 2 orders of magnitude less. However, the cost is also 2 orders of magnitude less.

There are two cost-reduction mechanisms involved. The first is the intercon-

# Introduction To The Multibus® II System Architecture

nect device. While the iPSB bus has 96 pins, the iSSB bus has only two.

The second consideration is packaging flexibility. The electrical requirements of the iPSB bus require it to be implemented in a very restrictive manner, with boards stacked and cables run to each device being controlled. On the other hand, the iSSB bus may be extended a distance of 10 meters, allowing boards to be scattered within a box or even be located in separate boxes. As VLSI devices become more capable, this will actually eliminate boards within a system by allowing the bus to be extended to the point of control. Thus, the iSSB bus has the ability to be physically distributed since it is no longer restricted to the backplane. However, it will likely remain inside the physical packaging of the system, even though it may extend short distances to connect a modular package.

As VLSI technology continues to shrink more and more functions into a single piece of silicon, the printed circuit board area needed to implement a function will

be decreased. In fact, today the interface to the iSSB bus can be implemented with a single chip. This level of integration will provide the lowest possible system cost. Further, the controller function found in contemporary systems will migrate to the printed circuit boards of the peripherals. The iSSB bus, then, allows reduced interconnect costs and physical distribution of system modules.

While taking advantage of the cost and distribution of a serial media, the iSSB bus allows functional modules to communicate with an identical software message passing interface to that of the Parallel System Bus. This means that modules that communicate via message passing on the iPSB bus can migrate easily to an iSSB bus with only minimal software changes.

Whereas the iPSB bus in combination with VLSI advances will offer increased capabilities at the same cost, the iSSB bus in combination with VLSI technology will offer the same capabilities at a lower cost.

## Multichannel™ DMA I/O Bus

Carried over from the Multibus I System Architecture, the Multichannel I/O Bus solves the problem of high-speed I/O data to and from physically distributed custom peripherals such as mass storage devices or graphics display systems. The Multichannel bus allows high-speed (8 megabytes/sec) block transfers of data over the data path between such peripherals and single board computers.

The Multichannel bus provides a standard

dized I/O interface with full speed operation at up to 15 meters with a simple asynchronous protocol. It supports up to 16 devices, both 8- and 16-bit and provides 16 megabyte memory or register address space per device. Typical uses of this bus include computer graphics, specialized peripheral control, data acquisition and high-speed Multibus system-to-system communication.

## iSBX™ I/O Expansion Bus

Also a carryover from the Multibus I System Architecture, the iSBX I/O expansion bus allows incremental on-board system expansion through the use of small iSBX Multimodule boards. Currently, iSBX boards add capability in the areas of parallel I/O, serial I/O graphics, bubbles and advanced mathematics functions. All iSBX boards afford system expansion

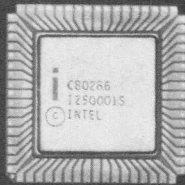
without the additional cost of adding another full expansion board.

The expansion bus allows users to customize their single board computers to individual applications in response to latest VLSI technology. Since they are able to buy exactly the capabilities needed, both system cost and system size are kept to a minimum.

(continued on page 132)



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CAN'T LEAVE A  
GOOD THING  
ALONE.**



# INTRODUCING THE iSBC<sup>®</sup> 286/10.

How could we leave it alone?

When you've introduced the highest performing 16-bit CPU on the market, you've just got to make it immediately available at the board level.

Look at the stand alone specs of the 286. It offers three times the performance of any other microprocessor. It's got memory management and protection, on chip. It has 16 Mb of physical memory. It's compatible with Intel's new 80287 Math Coprocessor. And it's more than a match for today's powerful 16-bit operating systems.

Now, imagine all that raw power in the company of an Intel board.

Powerful, yes. But we couldn't leave the 286/10 alone.

So we designed it as part of a family. Joining five other new high performance MULTIBUS<sup>®</sup> boards and a real-time operating system: Intel's new iRMX<sup>™</sup> 286R. Fully compatible with our industry standard iRMX<sup>™</sup> 86 Operating System and its languages.

But we still couldn't leave the 286/10 family alone.

So we designed it to be totally compatible with every one of our iSBC 86, 88 families. A MULTIBUS board for every price and performance level. Complete with software.

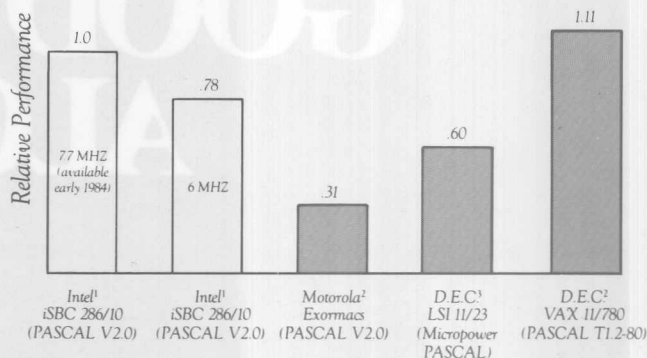
But then, we couldn't even leave all our boards alone.

Not with board extensions available. Like our new iLBX<sup>™</sup>. Intel's Local Bus Extension. It offers arbitration-free, direct access to high performance memory. With three times the performance of any other bus system.

All this togetherness comes down to Intel's concept of "Open Systems." Giving

designers and management complete flexibility, through our entire product line. Rapid, easy access to VLSI, via industry standards.

Performance Comparisons



<sup>1</sup>Based on Eratosthenes Sieve Benchmark in PASCAL. Details available from Intel's "Eratosthenes Sieve Prime Number Benchmark on the iSBC 286/10 Board," literature order number 210984. <sup>2</sup>"Eratosthenes Revisited," BYTE, Jan., 1983.

<sup>3</sup>"A System/Architecture Approach to Microcomputer Benchmarking," Digital Equipment Corporation, Sept., 1982.

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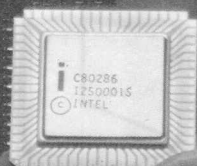
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# Introduction To The Multibus® II System Architecture

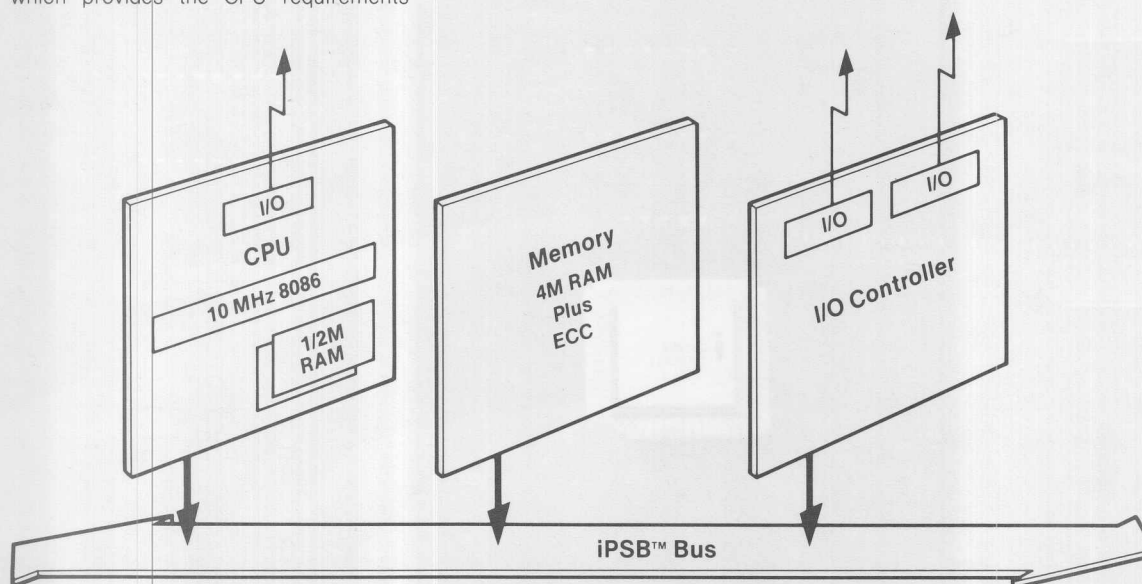
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## Building a Computer System for the Future

The advantages of the multiple bus approach of Multibus II System Architecture is easily demonstrated by a simple system that evolves over time to a family of products. Suppose the basic requirement is for moderate CPU power, variable sizes of RAM depending on system usage, and a variety of simple I/O devices.

The initial system may contain a sixteen bit microprocessor like the 10 MHz 8086 which provides the CPU requirements

(Figure 2). Considerable RAM can be placed on the same board as the CPU: up to one megabyte with 256K DRAMS and a RAM expansion Multimodule which mechanically does not require a second slot. The CPU board could still accommodate extensive I/O facilities such as serial, parallel, or analog I/O, as well as iSBX connectors for low-cost I/O additions to the base board.



- Execution on the iPSB™ Bus Via Memory Address Space
- I/O Control on the iPSB™ Bus Via I/O Address Space
- System Configuration Via Interconnect Space

**Figure 2. System Providing Basic Requirements**

Additional RAM can be added with memory boards on the Parallel System Bus with capacities up to 2 megabytes with 256K DRAMS and features such as parity or ECC. Additional I/O can be added on boards accessed via the Parallel System Bus with software compatibility with the on-board I/O. In both cases, the I/O is addressed via the I/O space of the 8086 since the iPSB bus supports an equivalent I/O space.

Finally, diagnostic and system start-up code can be written which utilizes the interconnect space to dynamically determine the features of the boards in the system. Thus, customization and incremental enhancement of the computer for each customer is simplified, resulting in greater customer satisfaction.

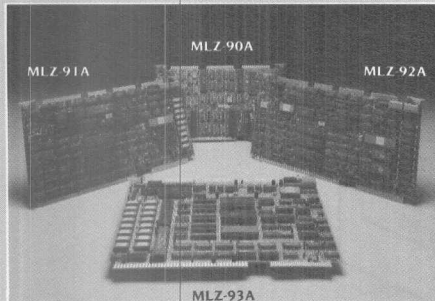
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# THERE IS MORE THAN ONE GOOD REASON TO CALL HEURIKON

**M**ake HEURIKON your source for Multibus microcomputers and system components.

Since 1972 Heurikon has been working hard to make life a little easier for those who "put it all together." Powerful Z-80™ and MC68000™ based Multibus™ microcomputers like MLZ-92A and HK68 have helped Heurikon customers find economical solutions for their problem applications.

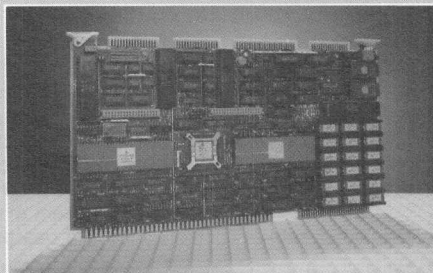


**MLZ-90A** single board microcomputer with nine byte-wide memory sockets for use with RAM or ROM (AM9511 and floppy disk drive controller optional).

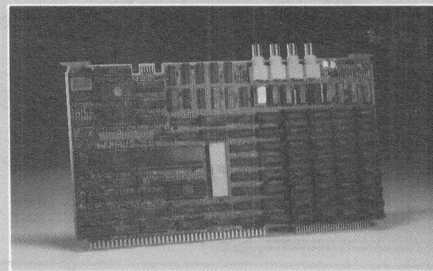
**MLZ-91A** single board CP/M™ system with on-card floppy disk drive controller, winchester interface, optional AM9511, streamer tape interface, two serial ports, one parallel port, 64K bytes RAM with parity, two EPROM sockets, and GPIB CONTROLLER.

**MLZ-92A** single board CP/M™ system with four serial ports on-card, floppy disk drive controller, winchester interface, optional AM9511, Centronics printer interface, 64K bytes of RAM with parity, and two EPROM sockets.

**MLZ-93A** single board CP/M™ system with 128K bytes of dual ported RAM, four EPROM sockets, floppy disk drive controller, optional AM9511 and powerful serial port features including SDLC and HDLC protocol support and modem controls.



**HK68™** powerful and versatile single board UNIX™ or CP/M-68K™ system with MC68000 CPU, MMU, quad channel DMA, four serial ports, 128K or 256K bytes of on-board RAM with parity (expandable to 1M byte on-board!), and two iSBX™ connectors for I/O expansion.



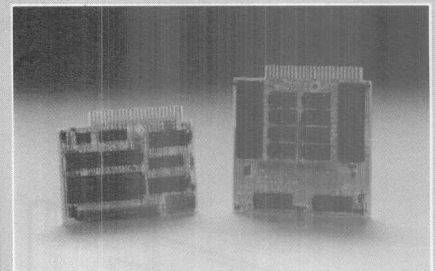
**MLZ-VDC** intelligent 640 x 480 x 4 color graphic controller based on the NEC 7220 controller chip with on-board Z-80 CPU, DMA controller, and user definable FIFO interface to Multibus™. Users may display up to 16 colors from a 4K palette. Up to 1024 x 1024 x 3 interlaced also available.

## iSBX Expansion Models

Heurikon also stocks iSBX™ modules for I/O expansion on its HK68 and MLZ-VDC. These modules may be used on any other board

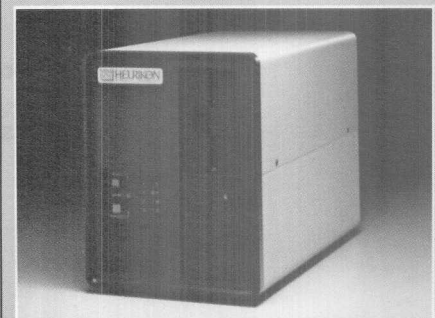
complying with Intel iSBX specifications.

Presently available are the SBX-FDIO floppy disk controller module and the SBX-SIO serial port expansion module.



The SBX-FDIO can control up to four single or double sided, single or double density 5¼ inch or 8 inch floppy disk drives. A software toggle allows both 5¼ inch and 8 inch drives to be intermixed on the same cable!

The SBX-SIO is a quad serial port expansion module utilizing Zilog SCC controller chips with built in baud rate generators. The SBX-SIO is available in synchronous and asynchronous models.



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Heurikon also supplies completely integrated systems with your choice of CP/M-80™, MP/M-80™, CP/M-68K™, and "Berkeley enhanced" Unix operating systems.

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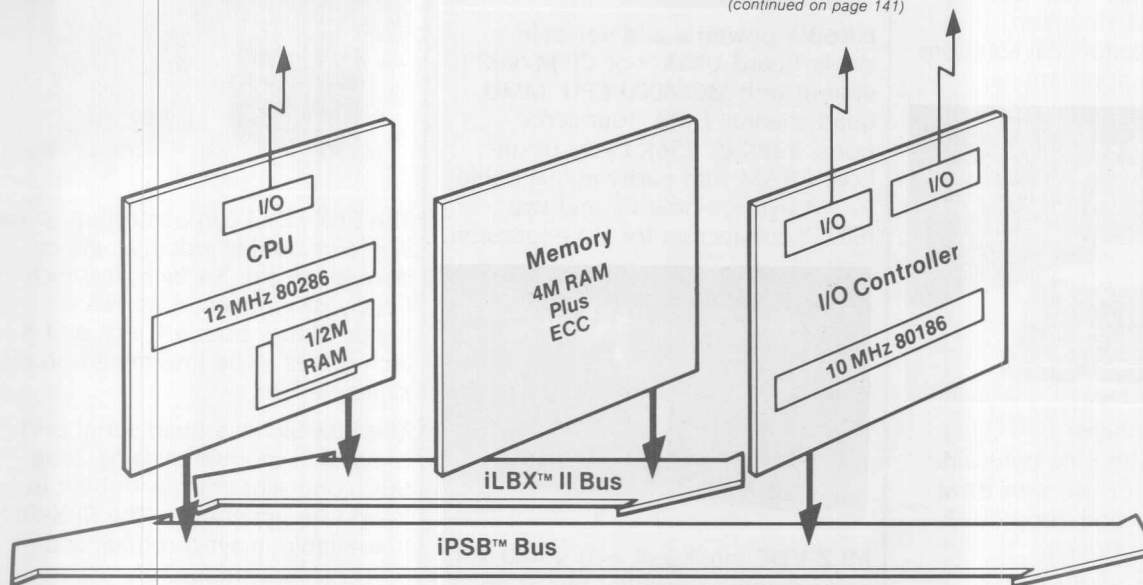
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## Increased CPU Demand

In time the computer will be expected to perform increased workloads as competitive pressures demand productivity improvements from the user. The processor board could be designed to use a 12 MHz 80286 processor (Figure 3). Alternatively, a second processor board could be added.

To save system bus bandwidth and expand performance with large memory sizes, the new processor board and memory could be designed with iLBX II bus interfaces. The two board set, connected via the iLBX II bus, will function as a virtual single board, independent of any other sets of iLBX II connected boards.

(continued on page 141)



- Processor Execution on the iLBX™ II Bus

Figure 3. System With Increased CPU Requirements

**Am97/8605**  
**16-Bit Monoboard**  
**Computer**

**High Performance**  
**8086 CPU**

ADVANCED MICRO DEVICES

Sockets for up to  
 64k bytes of ROM

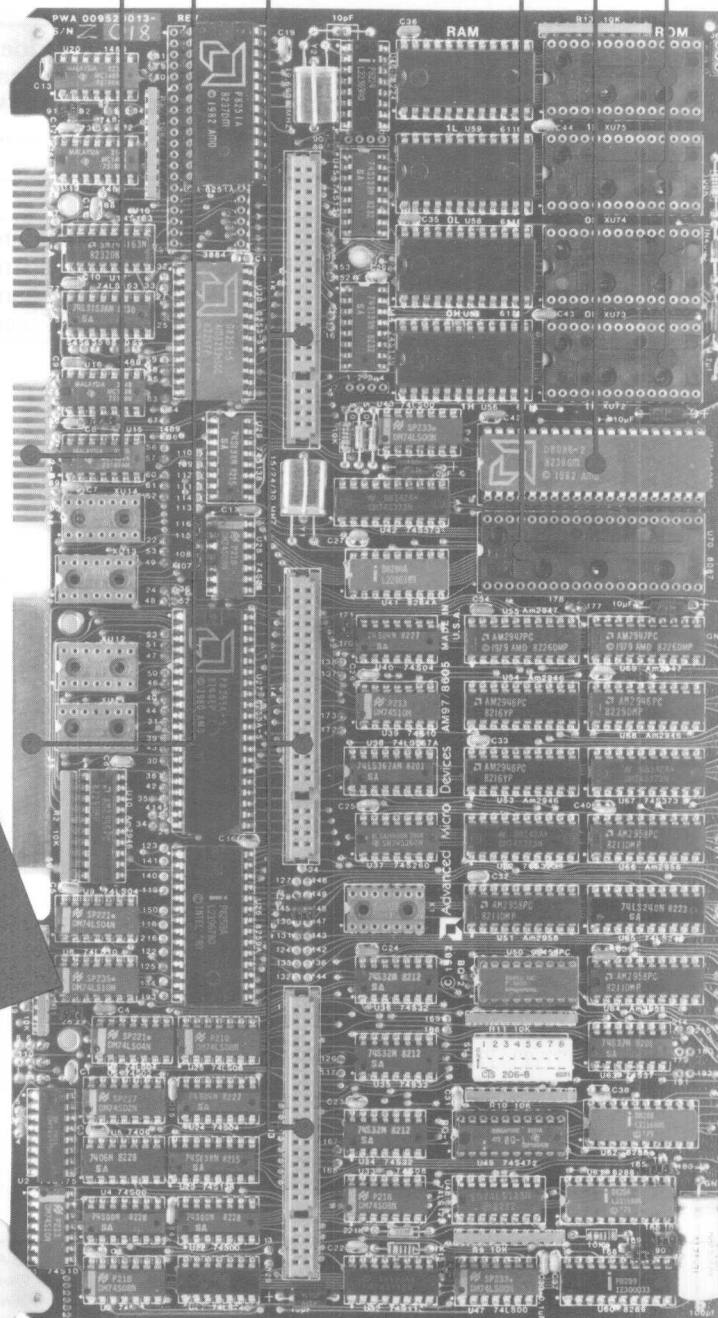
16-bit 8086  
 processor

On-board 8087  
 coprocessor socket

Three SBX  
 connectors

24 programmable  
 parallel I/O lines

Two serial RS-232  
 port capability



**CPU with  
 plug-in options  
 solves design  
 problems**



Advanced Micro Devices' new Am97/8605 is a powerful 16-bit Multibus\* computer board. Its 8086 microprocessor and optional on-board 8087 numeric coprocessor provide exceptional throughput and interrupt handling capabilities. The Am97/8605 includes both serial and parallel ports, three counter/timers, static RAM, four 24/28-pin memory

sockets, three SBX bus connectors, and an interrupt controller.

The large EPROM capacity, extensive I/O, and multi-master capabilities make the Am97/8605 ideally suited for ROM-intensive control and I/O applications. It is designed to operate as a standalone CPU as well as a slave CPU in a multimaster system.

Features of the Am97/8605 include:

- Plug compatibility with Intel's iSBC\* 86/05 Board
- Fully software transparent with Intel's iSBC 86/05 and iSBC 86/12 Boards
- 8086 options for 5 or 8 MHz operation
- Optional on-board 8087 Numeric Coprocessor
- Three SBX Connectors

The Am97/8605 has built-in expandability. Custom I/O and other special functions can be added through the use of three SBX bus connectors. An

additional serial port can be added by substituting one UART chip, and on-board memory can be doubled by installing the Am97/0343 Memory Module.

#### Ordering Information

AMD P/N	Intel P/N	Description
Am97/8605-005	iSBC 86/05	5MHz 8086 CPU Board without an 8087
Am97/8605-008	iSBC 86/05	8MHz 8086 CPU Board without an 8087
Am97/8605-010	N/A	10MHz 8086 CPU Board without an 8087
Am97/8605-105	N/A	5MHz 8086 CPU Board with an 8087

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**Am97/0000  
Series  
RAM Boards**

**Fast Multibus\*  
Memory**

ADVANCED MICRO DEVICES

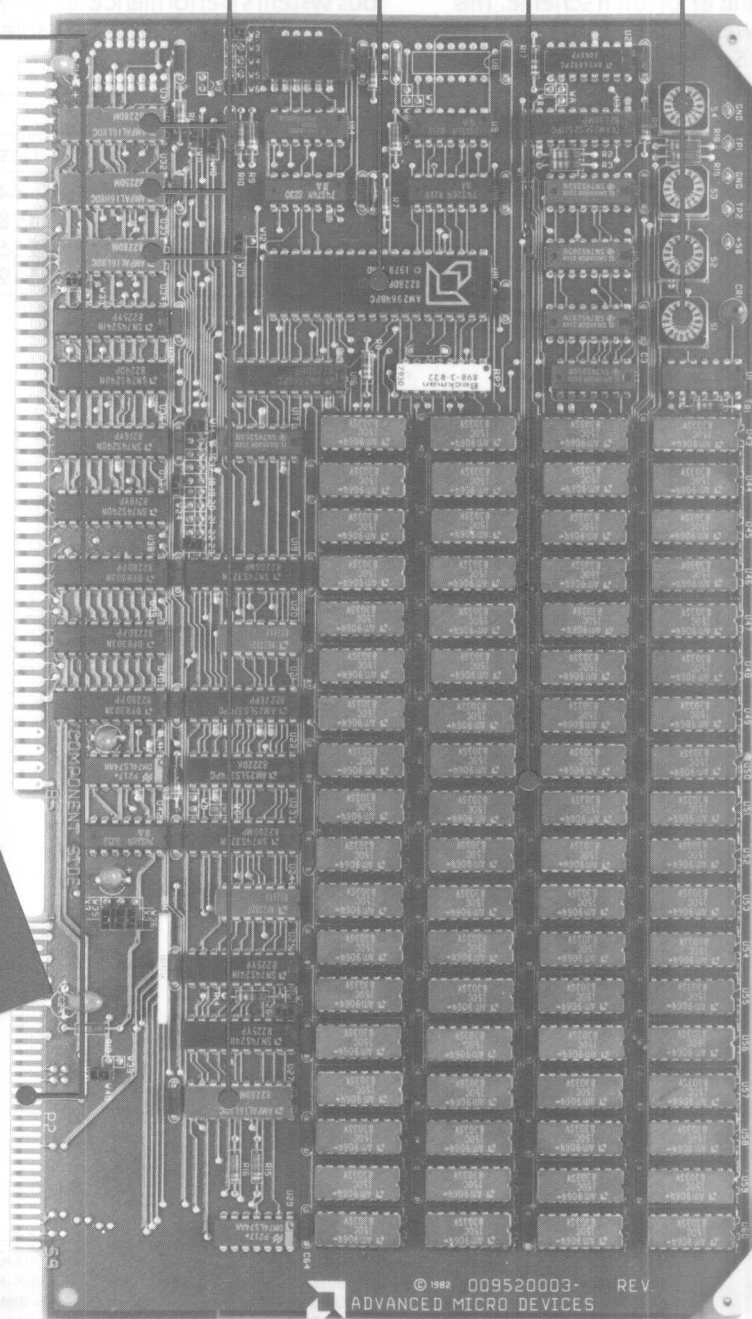
Set starting address  
directly in  
hexidecimal

High speed RAM  
array (150ns parts)

Incorporates the  
Am2964B  
advanced memory  
controller

Four PALs\* provide  
faster operation  
and enhanced  
reliability

Extended multibus  
with 24-bit  
addressing and  
power back-up  
lines



**Memory that  
doesn't keep  
you waiting**

The new Am97/0000 Series of Multibus memory boards are Real Performers! With access and cycle times 30% faster than Intel's boards, lower power

consumption, and enhanced reliability, they have the features necessary for today's fast 8- and 16-bit computer systems.

- Plug compatibility with Intel's iSBC\* 064A, 056A, and 012B RAM Memory Boards
- Board memory starting on any 4K byte boundary within the 16M byte addressing range
- High-speed access and cycle times with low power consumption
- Support for 16, 20, and 24-bit addressing
- Compatibility with 8- or 16-bit processors
- On-board parity with latching error registers and selectable interrupt generation
- User-selectable and adjustable Advanced Acknowledge

Our boards use the Intel 24-bit extended Multibus format and have the same error latch scheme. This makes them both hardware and software transparent to the Intel boards. So, if you want a strong Intel

second source or you want to increase your Multibus system's performance, specify the Am97/0000 Series of Memory Boards available from Advanced Micro Devices.

#### Ordering Information

AMD P/N	Intel P/N	Description
Am97/0064	iSBC 064A	64K Byte RAM Board
Am97/0128	iSBC 028A	128K Byte RAM Board
Am97/0256	iSBC 056A	256K Byte RAM Board
Am97/0512	iSBC 012B	512K Byte RAM Board

\*Multibus and iSBC are registered trademarks of Intel Corporation.

\*PAL is a registered trademark of Monolithic Memories Inc.



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Micro  
Devices

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Santa Clara, CA 95051

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Toll Free: (800) 672-3548 (California)  
(800) 538-9790  
TWX: 910-338-7659  
Telex: 17-1142

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03802A-MCS P 5/83  
LB-B-30M-5/83-0  
Printed in U.S.A.

# Am97/0000B Series of Megabyte RAM Boards

## Fast Multibus\* Memory

ADVANCED MICRO DEVICES

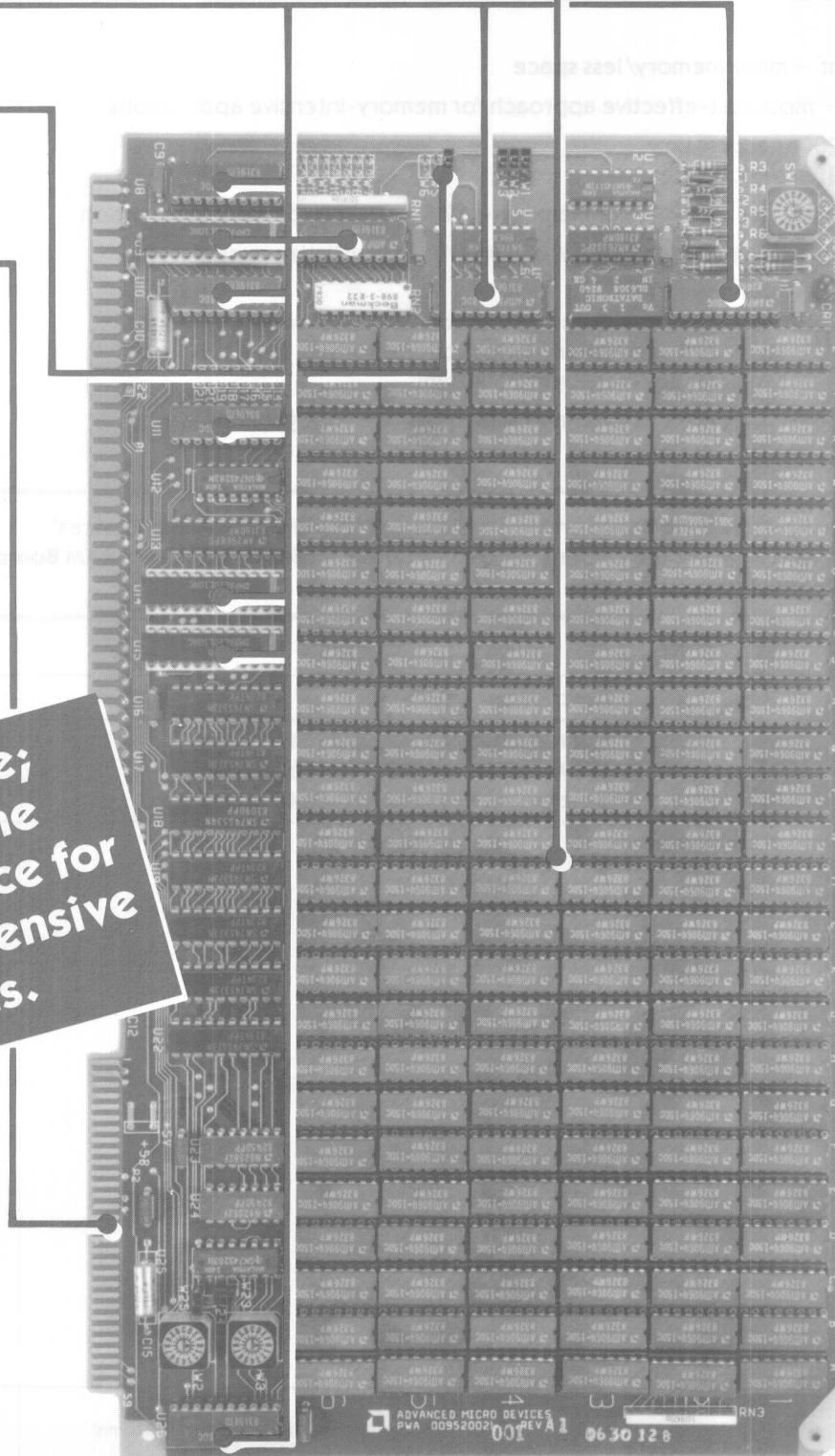
Up to ONE  
MEGABYTE of  
high-speed, 64K  
dynamic RAM  
memory

Low power  
consumption  
via PALs\*

User-adjustable  
acknowledge  
(XACK/ or AACK/ )  
signals optimize  
performance

Extended  
Multibus with  
24-bit addressing  
capability and  
power back-up  
lines

One Megabyte;  
one board. The  
perfect choice for  
memory-intensive  
applications.



## Fast Multibus\* Memory

The Am97/0000B Series of RAM boards make use of the latest in dynamic memory board technology to provide up to ONE MEGABYTE of fast 64K

dynamic RAM memory on a single board. These high-performance, low-power boards have the features needed for today's memory-intensive systems.

### Features/Benefits

- Reduce board count — more memory/less space
- Lower system cost — most cost-effective approach for memory-intensive applications
- High speed — max 200ns access time  
max 300ns cycle time
- Half the power required per megabyte of memory — 12.5 watts max power consumption
- User-adjustable acknowledge signals (XACK/ or AACK/) — to optimize overall system performance
- Addressing flexibility — 64K boundary address resolution within 16 megabyte range
  - lower 32K and upper 64K lockout options
  - can cross any megabyte boundary
- On-board parity with latching error register and selectable interrupt generation
- On-board automatic refresh

So if you're looking for a way to reduce board and slot count, reduce costs, and increase the amount of high-performance Multibus memory for your

system, ask for Advanced Micro Devices' **Am97/0000B Series of Megabyte RAM Boards.**

### Ordering Information

AMD P/N	Description
Am97/0512B	1/2 Megabyte RAM Board (512K Bytes)
Am97/0768B	3/4 Megabyte RAM Board (768K Bytes)
Am97/1024B	1 Megabyte RAM Board (1024K Bytes)

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# Introduction To The Multibus® II System Architecture

## Increased Data Movement

With an increased demand for services of the I/O, preprocessing of the data will be required to reduce the information flow to only the relevant data. This can be accomplished by adding processor power to the I/O interfaces. As standard interfaces are desirable to preserve the software investment, the simple I/O address mapping of the example would be replaced with a higher level procedural interface. This higher level would be provided by software for on-board I/O. The off-board I/O, however, is more complicated.

The data could be moved between processors via shared memory, but this would require the addition of a memory board or a dual port facility for shared memory. The Multibus II Message Passing Facility is intended to simplify the design and configuration of such systems while maintaining an equivalent performance of the more tightly coupled design (Figure 4).

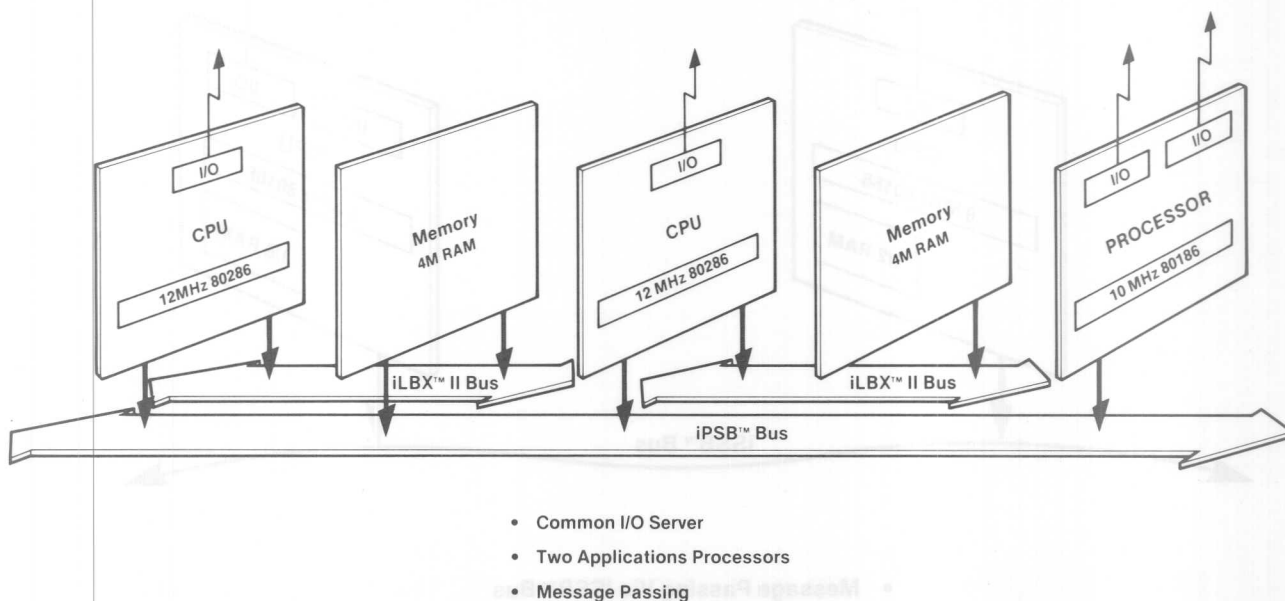


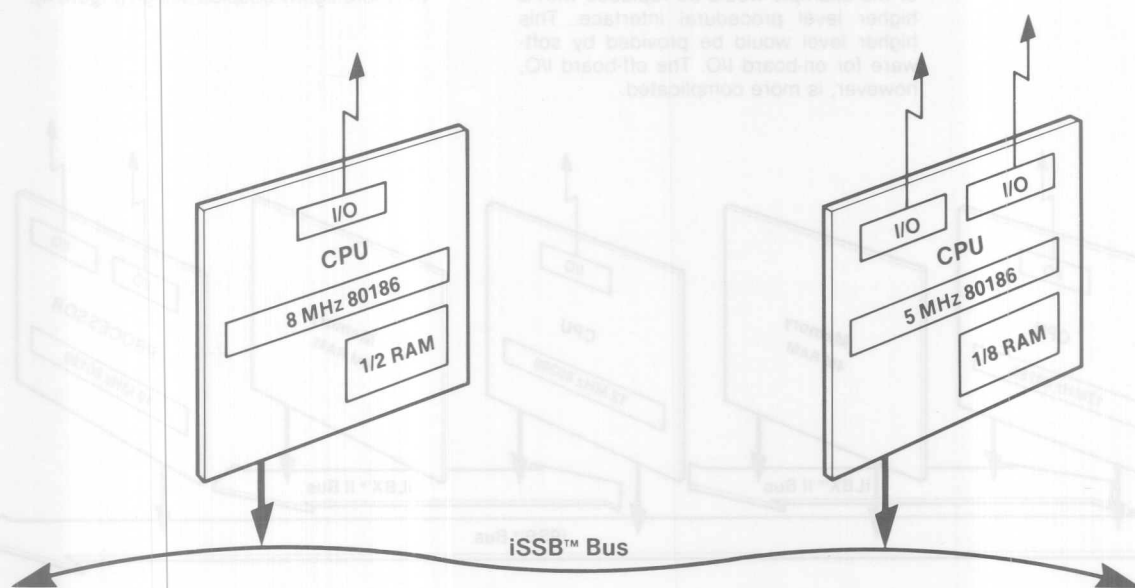
Figure 4. Enhanced Support of Multiple Processors

# Introduction To The Multibus® II System Architecture

## Lower Cost Requirements

With a successful system, competition will attempt to undermine the leader's market share with lower cost. Furthermore, a low-cost system design is often required to achieve design wins that lead to future product sales of more costly systems. The Multibus II Serial System Bus allows a low-cost implementation of

the message-passing facility of the Parallel System Bus with complete software compatibility. Thus, the software investment is protected and leveraged in low-cost designs based on highly integrated processors such as the 80186 (Figure 5).



### • Message Passing Via iSSB™ Bus

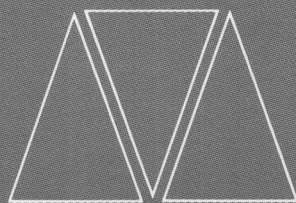
Figure 5. Low-Cost System Design

## Summary

This overview has attempted to present the characteristics of the Multibus II System Architecture, an advanced open system multiple bus architecture. Its intent has also been to demonstrate the attributes of the Multibus II buses: the 32-bit Parallel System Bus with its 40 megabytes/sec throughput and effective support of multiple processors; the iLBX II bus with its high-speed access to large

amounts of off-board memory; and the Serial System Bus, a low-cost alternative to the message-passing facilities of the Parallel System Bus.

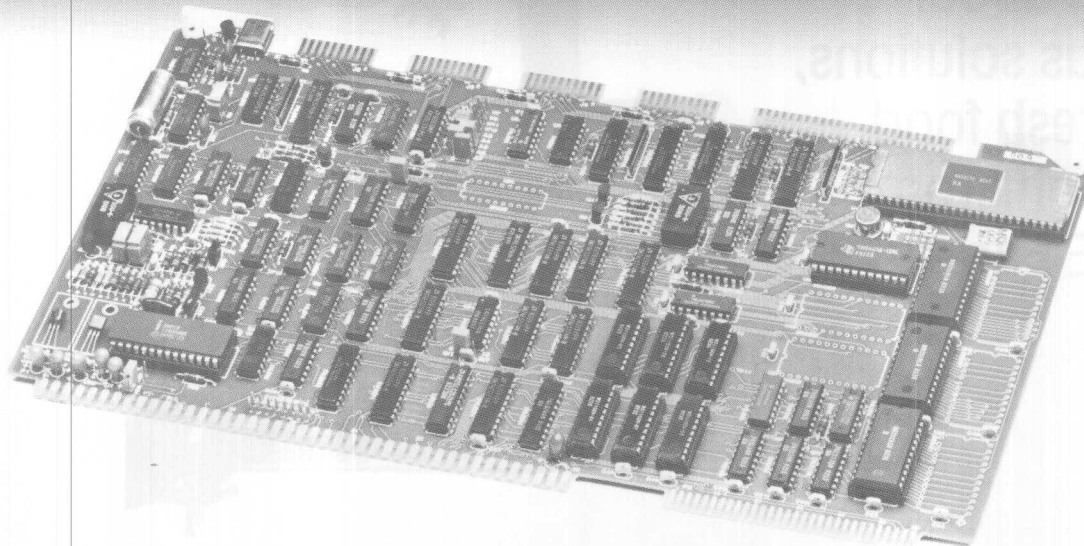
Individually, the buses represent significant advances in bus design. Together, they represent an evolutionary path to future VLSI technology. ■



## **MINI COMPUTER TECHNOLOGY**

**MULTIBUS\*  
SMD\*  
Controller**

**MULTIBUS\*  
ST506/SA1000  
Controller**



Mini Computer Technology offers microprocessor based intelligent disk controllers for Multibus applications. The Model MCT 4300 will control up to four disk drives with standard SMD interface - each drive can have different capacities. The Model MCT 4500 controls up to four disk drives of either 5¼" or 8" with an intermix of ST/506 or SA/1000 interface.

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## **MINI COMPUTER TECHNOLOGY**

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United Kingdom  
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Telex: 847423 COCRG

Mini Computer Technology  
696 East Trimble Road  
San Jose, CA 95131  
  
(408) 942-1616  
Telex: 910 338 2281

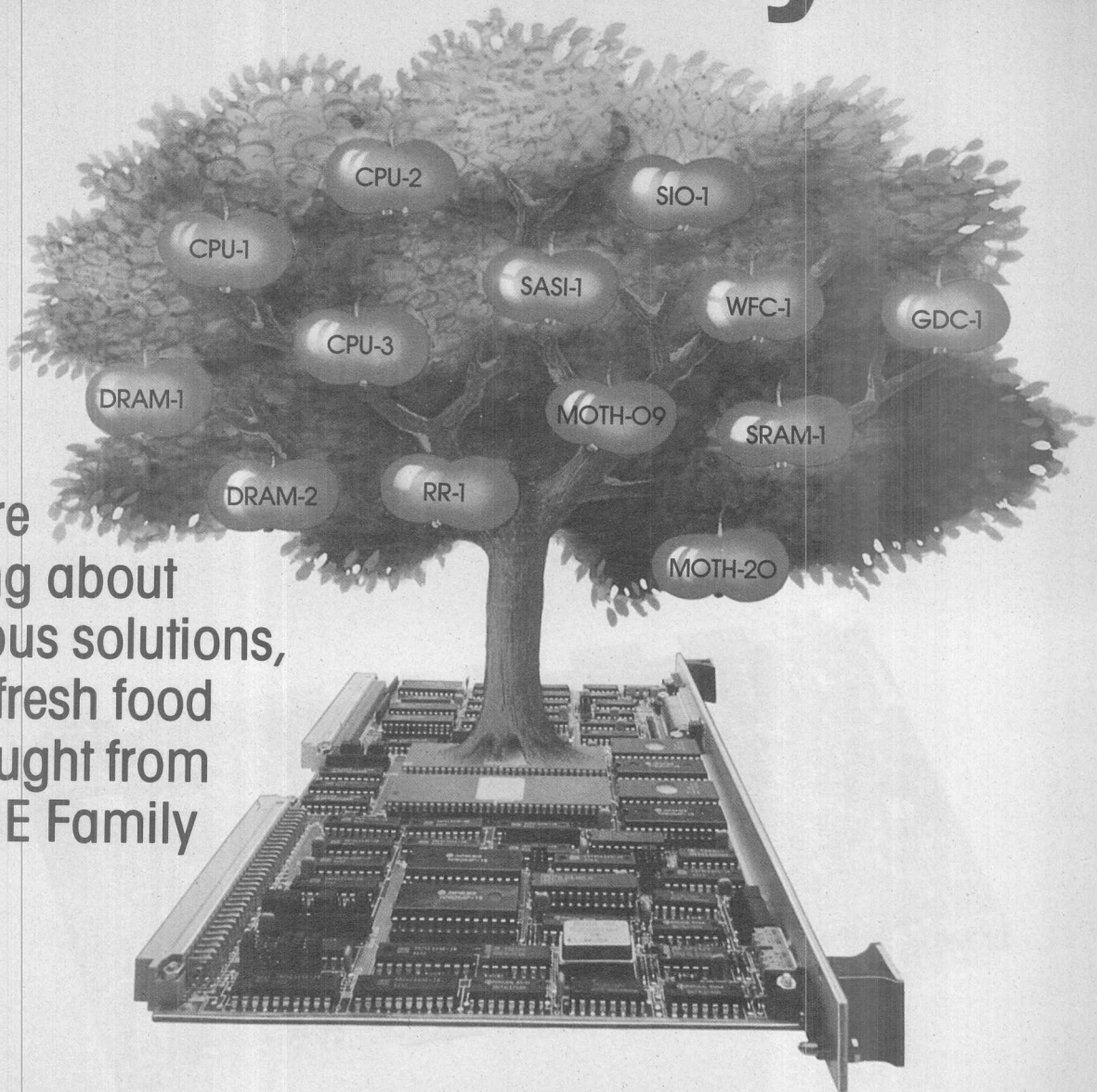
Mini Computer Technology  
P.O. Box 1663  
Apple Valley, CA 92307  
  
(619) 247-4469  
Telex: 910 338 2281

\*MULTIBUS is a registered trademark of Intel Corp. \*SMD is a registered trademark of Control Data Corp.



# The VME Family Tree

If you're thinking about other bus solutions, here's fresh food for thought from the VME Family Tree.



**SYS68K/CPU-1**, 68000MPU 8 MHz (10 MHz) 128KB DRAM expandable to 512KB, RTC, 3xRS232, Price \$ 1.450,- + Tax, available.

**SYS68K/CPU-2**, 68000 MPU 8 MHz (10 MHz) 128 KB (512KB) Dual ported DRAM, RS232C, parallel I/O, slave bus arbitration, Price \$ 1.795,- + Tax, available Oct. 83.

**SYS68K/CPU-3**, 68000MPU 10 MHz optional, DMAC, MMU, bus arbitration, Price \$ 2.200,- + Tax, available Dec. 83.

**SYS68K/DRAM-1/-2**, 512KB/2MB, byte parity, write acc. 210 ns (max.), read acc. 320 ns (max.),

Price DRAM-1 \$ 1.680,- + Tax, DRAM-2 \$ 5.590,- + Tax, available.

**SYS68K/SRAM-1**, 128KB SRAM expandable to 512KB, battery back-up, Price \$ 1.600,- + Tax, available.

**SYS68K/MOTH-09/20**, 9/20 DIN 41612C Female connectors, Price MOTH-09 \$ 470,- + Tax, MOTH-20 \$ 980,- + Tax, available.

**SYS68K/SASI-1**, handling processor, DMA-controller for up to 4 MByte per sec. transfer rate and interrupt capability. Floppy, Winchester, and Tape control via SASI Bus, Price \$ 1.680,- + Tax, available.

**SYS68K/SIO-1**, 6 serial multi protocol channels RS232 and RS422, programmable Baud rate, Price \$ 985,- + Tax, available.

**SYS68K/RR-1**, 8 memory banks max. 512KB, mixed use of ROM's, EPROM's, PROM's or SRAM's, each bank separately jumperable, battery back-up, Price \$ 885,- + Tax, available.

**SYS68K/WFC-1**, up to 4 Floppy + 3 Winchester drives, 5 1/4 inch, programmable sector size, ECC diagnostics, Price \$ 1.680,- + Tax, available Oct. 83.

**SYS68K/GDC-1**, min. 16 colors, 256KB display memory, 1Kx1K

Pixels, handling processor. Price \$2.780,- + Tax, available Dec. 83.

**Available Software:** Monitor, Editor/68000 Ass., Basic-68K, Forth-68K. Realtime multitasking Nov. 83. Multiuser operating system Dec. 83.

All CPU boards are prepared to run UNIX\* and CPM68K\*\*. \*UNIX is a trademark of Bell Labs \*\*CPM68K is a trademark of Digital Research

FORCE COMPUTERS INC.  
2041 Mission College Blvd.  
Santa Clara, California 95054  
Phone (408) 988-8686  
Tlx 172465



FORCE COMPUTERS GMBH  
Freischützstraße 92  
8000 München 81  
Telefon 0 89/9510 41-44  
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# Floppy Disk Controllers

---

Aim Technology  
AMD  
Central Data Corporation  
Century Computer Corporation  
Comark Corporation  
Densan Co., Ltd.  
Distributed Computer Systems  
Intel Corporation  
Interphase Corporation  
Matrox Electronic Systems  
Megalogic Corporation  
Micromation, Inc.  
Micro/Sys, Inc.  
Mini Computer Technology  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Xebec  
Zendex Corporation

# Floppy Disk Controllers

Manufacturer	Model	Price	DFA	Deliv.	No. of Drives		Single		Dual		DMA	CRC
					8"	5 $\frac{1}{4}$ "	Side	Density	Side	Density		
Aim Technology ..... (408) 727-3711	FCF008	\$ 690	4/83	stk	4	4	o	o	o	o	-	o
AMD ..... (408) 988-7777	Am95/6120	\$1095	5/80	stk	4	4	o	o	o	o	o	o
	Am95/6110	\$ 945	1/80	stk	4	-	o	-	o	-	o	-
Central Data Corporation ... (217) 359-8010	BL015	\$ 400	3/80	stk	4	-	o	-	o	o	o	o
	BL015/ 5.25	\$ 475	★8/83	-	-	4	o	-	o	o	o	o
Century Computer ..... Microtrak, Inc.	F-200	\$ 450	12/82	-	4	4	o	o	o	o	o	-
Comark Corporation ..... (617) 359-8161	MF 85	\$ 695	7/81	-	4	3	o	o	o	o	o	-
	MF 80	\$ 995	7/81	-	4	4	o	o	o	o	-	-
Densan .....	DSB 201	\$-	-	-	2	2	o	o	-	-	o	-
Distributed Computer ..... (617) 890-8200	DCS	\$ 600	-	-	o	o	o	o	o	o	-	-
	DCS/SASI	\$ 750	★11/83	stk	4*	4*	o	o	o	o	o	o
	DCS/ISI	\$ 650	★10/83	stk	4	-	o	o	o	o	o	o
Intel Corporation ..... See Sales Office Listing	iSBC 208	\$1065	-	-	4	4	o	o	o	o	o	-
	iSBC 204	\$ 780	-	-	2	2	o	o	o	-	-	o
	iSBX 218	\$ 540	-	-	4	4	o	o	o	o	-	-

# Floppy Disk Controllers

Multimaster	Recording Format	Data Bus (bits)	Address (bits)	Distinguishing Features
o	IBM 3740 IBM System 3	8-16	20	IBM Compatible soft-sector recording format; single/double density; single/double sided; includes 48Kbytes of dual ported RAM.
o	IBM 3740 System 34	8-16	20	Provides dynamic, high speed DMA transfers of up to 1.8Mbits/sec in block, burst, or byte modes. Has Am8085A CPU with 1Kbyte of RAM and FD1793 disk controller.
o	IBM 3740	8-16	20	Easy to use single density floppy disk controller.
o	MFM	8	24	
o	MFM	8	24	
-	-	-	-	iSBX Module, up to 4 drives any combination.
-	IBM 3740	8	-	Am9511A math chip socket, CPM compatible.
-	Intel	8	-	SBC 201, SBC 202 compatible.
-	IBM 3740	-	-	
-	IBM 3740 FM/MFM	8	20	Has IEE 488, DMA option.
o	IBM 3740 FM/MFM	8	24	Any combination totaling 4. Also has SASI generic Winchester, DMA, controller.
o	IBM 3740	8/16	24	Also has CDC ISI standard native interface, also DMA.
-	IBM 3740 System 34	8	16	Up to 4 drives with up to 8 surfaces.
-	IBM 3740	8	16	1 drive when double sided. Double capacity by adding optional 8271 FDC chip.
-	IBM 3740 System 34	8	-	Multimodule, on-board data separator, phase locked loop.

continued next page

# Floppy Disk Controllers

Manufacturer	Model	Price	DFA	Deliv.	No. of Drives		Single		Dual		DMA	CRC
					8"	5 $\frac{1}{4}$ "	Side	Density	Side	Density		
Interphase Corporation ..... (214)350-9000	SDC 2203	\$1795	-	-	4	-	o	o	-	o	o	o
Matrox Electronic ..... (514)735-1182	FFD-1	\$ 625	-	-	4	4	-	-	-	o	o	-
	FFD-1/32	\$1360	-	-	4	4	o	o	o	o	o	-
Megalogic Corporation ..... (513)833-5222	MIS-LHS	\$ 895	-	-	-	4	o	o	o	o	-	o
Metacomp Inc. .... (619)578-9840	MPX-2000 310	\$ 295	-	-	-	-	-	-	-	-	o	-
Micromation ..... (415)398-0289	MM-SBC- 80F	\$1000	78	stk	4	4	o	o	o	o	o	o
Micro/Sys ..... See Sales Office Listing	FD7650	\$ 720	1/81	30da	4	4	o	o	o	o	o	o
National Semiconductor ..... See Sales Office Listing	BLC-8224	\$ 800	-	stk	4	4	o	o	o	o	o	o
	BLC-8222	\$ 800	-	stk	4	4	o	o	o	o	o	o
Mini Computer Technology ... (408)942-1616	MCT-4500	\$1350	-	-	4	4	-	-	-	-	o	-
NEC Electronics ..... (617)655-8833	BP2190	\$ 895	1/80	stk	4	3	-	o	o	o	o	-
Xebec ..... (408)733-4200	SL410	\$ 295	-	-	-	2	o	o	-	-	-	o
Zendex Corporation ..... (415)828-3000	ZX-200A	\$1500	10/80	stk	4	-	o	o	-	o	o	o
	ZX-203	\$2795	3/83	-	4	-	o	o	-	o	o	o
	ZX-205	\$ 506	5/80	stk	4	4	o	o	o	o	o	o
	ZX-208	\$ 980	9/81	stk	4	4	o	o	o	o	o	o
	ZX-218B	\$ 480	-	stk	4	4	o	o	o	o	-	o



Multimaster	Recording Format	Data Bus (bits)	Address (bits)	Distinguishing Features
o	ISSIS II	8	16	Emulates 201, 202 & 206 with SASI adapter; second source for Zendex ZX-203.
-	IBM 3740 IBM System 34	8-16	16	32Kbytes dual-port RAM.
-	IBM 3740 IBM System 34	8-16	16	
-	-	-	-	
-	-	-	-	SASI/SCSI Interface module for DMA to any SASI/SCSI bus including 5¼" and 8" floppy disk drives. Operates with Metacomp MPA-2000.
-	Intel, IBM 3740 IBM System 3	8	8	Replaces iSBC 201 and 202.
o	IBM	8	16	
o	IBM 3740 IBM System 3	16	24	16Mbyte addressing range, compatible with slim line and mini-floppier.
o	IBM	8	16	Sockets for 8K or 16K of EPROM. Boot strap overlay capability.
-	-	8	16	Blocking/deblocking, bad sector detection/reassignment, and retry and error performed by controller firmware. Optional SMD controller (intelligent) \$1675.
-	IBM	8	16-20	IBM compatible soft-sector recording format; single/double density; single/double sided; 8" or 5¼" drives; includes 48Kbytes of dual-ported RAM.
-	-	-	-	On-board data separator, Shugart SA 1400 host interface.
o	ISIS-II (MMFM)	8	20	Direct Shugart SA 801 interface. Replacement for Intel iSBC 201 and 202.
o	ISIS-II (MMFM)	8	20	Replaces iSBC 201, 202, 206. Same as ZX-200A but includes a SASI bus host adapter.
o	IBM (MFM)	8	16	Economical O.E.M. disk controller.
o	IBM (MFM)	8	24	Alternate to Intel iSBC 208.
iSBC	IBM (MFM)	8	16	Enhanced replacement for Intel SBX 218.

# MULTI BOOST™

## XYLOGICS CONTROLLERS ADD THRUST TO YOUR MULTIBUS® SYSTEM.

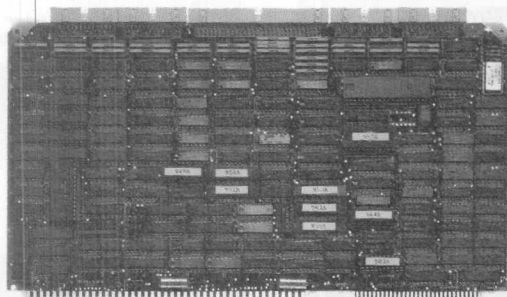
### THE 450 SMD DISK CONTROLLER.

It simply outperforms any other high capacity Multibus disk controller.

With DMA speed up to 3.0 MB/sec. Non-interleaved data transfer up to 1.9 MB/sec. And 2 or 8KB FIFO buffering. The Xylogics 450. The fastest SMD disk controller available anywhere for Multibus applications.

And its unparalleled versatility and capacity make it the choice of OEMs. It supports as many as four SMD disk drives, is programmable to any configuration, and works with any 16, 20 or 24 bit address system.

All this power resides on a single IEEE-796 bus compatible board. Multiboost from Xylogics. Is it any wonder that Xylogics has sold more high performance Multibus peripheral controllers to more major OEMs than anyone else in the world?



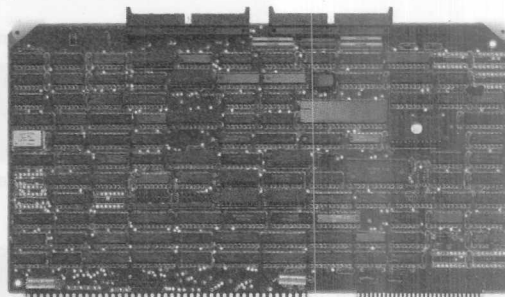
### THE 472 TAPE CONTROLLER.

The state-of-the-art Multibus tape controller that outperforms all others in price and features.

Fast DMA up to 3.0 MB/sec. Channel control for true high-speed streaming with no repositioning. And 2 or 8KB FIFO buffering. The Xylogics 472. The fastest Multibus tape controller on the market.

And the most advanced. The 472 supports up to eight Pertec formatted streaming and start/stop tape drives. Runs at speeds up to 125 ips and at densities up to 6250 bpi GCR. Programmable to any drive mix. And it occupies only one backplane slot in any 16, 20 or 24 bit address Multibus system.

Expand the universe of Multibus microprocessing with Multiboost from Xylogics. The peripheral performance leader.



*The Peripheral Performance Leader.*

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Tel: (617) 272-8140 TWX: 710-332-0262  
(800) 225-3317 outside of Massachusetts

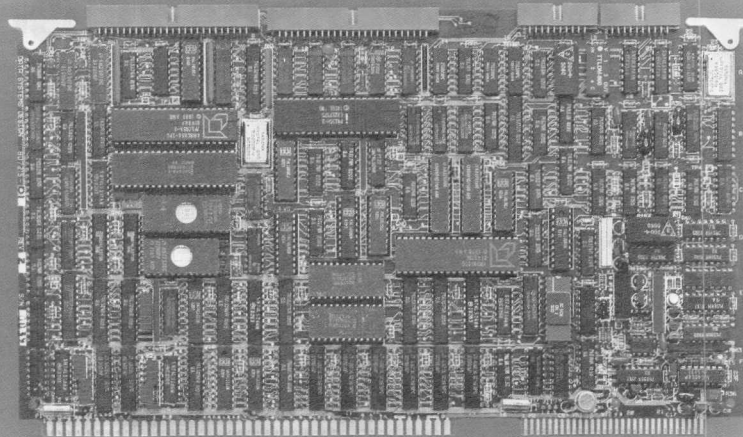
Xylogics European Headquarters: (Slough, U.K.)  
Tel: (0753) 78921 Telex: (851) 847978

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\*\*MULTIBOOST is a trademark of Xylogics, Inc.

## Other Peripheral Controllers

ADES  
Alloy Engineering  
AMTELCO  
Central Data Corporation  
Ciprico, Inc.  
Comark Corporation  
Control Data Corporation  
Data Systems Design  
Data Technology Corporation  
Distributed Computer Systems  
EMM/Sesco  
Ikon Corporation  
Intel Corporation  
Interphase Corporation  
Konan Corporation  
Megalogic Corporation  
Mesa Technology Corporation  
Metacomp, Inc.  
Micro Industries  
Microcomputer Systems  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Scientific Micro Systems  
Shugart Associates  
Systech Corporation  
Zylogics

# ONE SLOT SHOPPING.



## INTRODUCING THE WINCHESTER/FLOPPY/TAPE THREE-IN-ONE MULTIBUS CONTROLLER.

### Try this on for size.

DSD's new 7215 single-board Multibus® controller/interface handles two SA1000-type 40Mb Winchester, a 1/4" streamer, and two 8" floppies.

Plus on-board data separation, 32-bit ECC, and self-diagnostics. All on the same board.

There's also a version for 5 1/4" drives, the 5215, with similar capabilities.

And both are very, very quick.

Thanks to a pipelined architecture that moves data at non-interleaved speeds.

### Top-of-the-line performance.

The 7215 and 5215 are the highest performance controllers on the market for 8" and 5 1/4" drives.

And that makes them ideal for multiuser and UNIX™ applications.

They also emulate Intel® iSBC® 215 and iSBX™ 218 controllers so you can run RMX 86 anytime.

And with 24-bit addressing support, you can take advantage of high performance microprocessors like the 68000 and the new inexpensive memory chips to address larger physical RAM memory.

To tune system performance, both boards offer four alternatives for bus arbitration. As well as having the capability to boost system performance by performing overlapped seeks and multisector operations.

### Plus the convenience to match.

The best part about all this performance is that it comes on one board. So it only takes up one back-plane slot. And there are no extra boards to fool with.

As easy as that sounds, there are those of you who'd rather not do-it-yourself. For you, the 7215 controller is also available in our 770 storage systems.

And like all DSD products, our Multibus boards and systems are supported by our exclusive Rapid Module Exchange™ and regional service centers.

### Shop around.

Compare our incomparable Multibus boards and systems to anything else you like. To make it easy, just send your business card to DSD Corporate Headquarters, Marketing Communications Department, for a free copy of "The Multibus Buyers Guide."

**Corporate Headquarters:** 2241 Lundy Avenue, San Jose, CA 95131. **Eastern Region Sales and Service:** Norwood, MA, (617) 769-7620. **Central Region Sales and Service:** Dallas, TX, (214) 980-4884. **Western Region Sales:** Santa Clara, CA, (408) 727-3163. **International Sales:** San Jose, CA, (408) 946-5800.

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™UNIX is a trademark of Bell Laboratories.

™Rapid Module Exchange is a trademark of Data Systems Design, Inc.

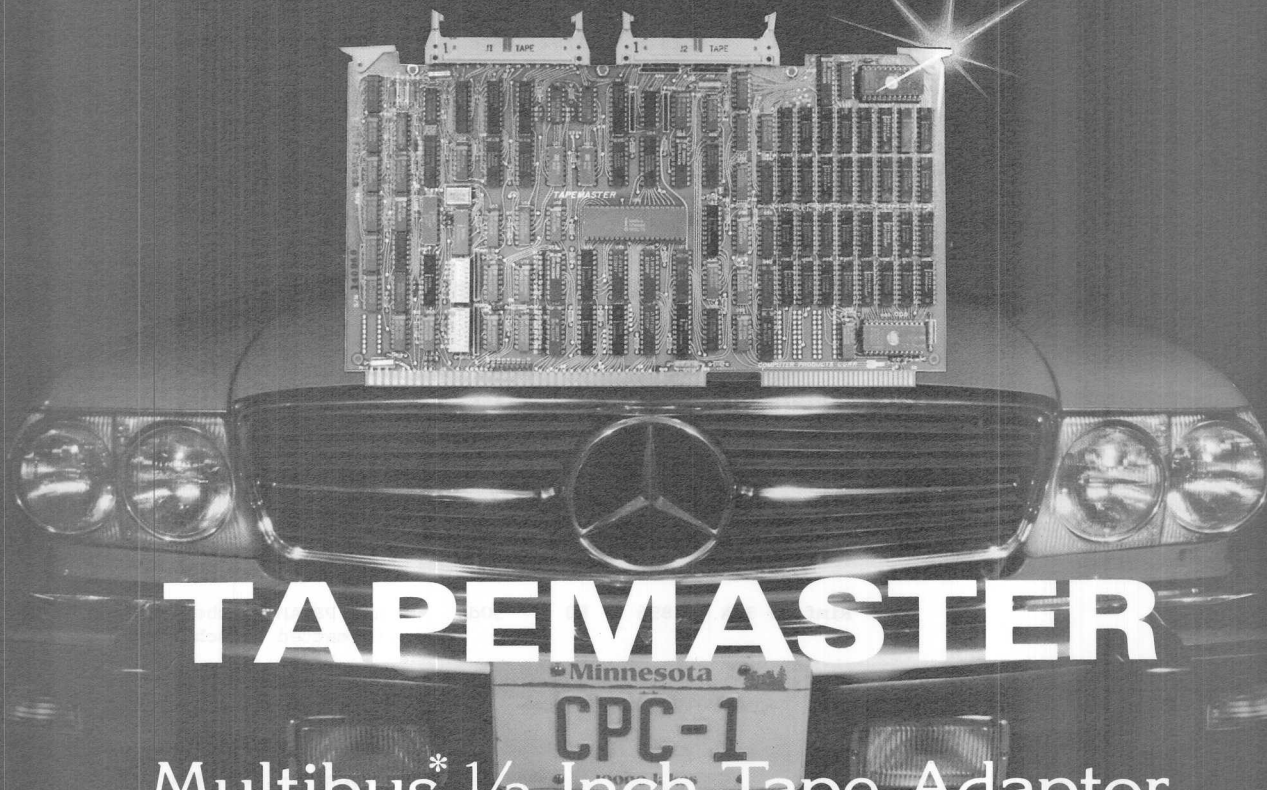
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## DATA SYSTEMS DESIGN



# SOME PRODUCTS

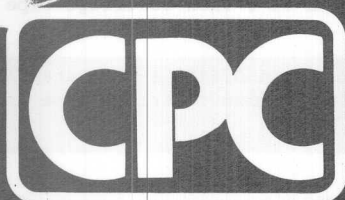
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Lead The Pack



## TAPEMASTER

Multibus\* 1/2-Inch Tape Adaptor  
The First. The Best.

- Controls up to 8 formatted drives in any combination of streaming or start/stop, NRZI, PE or dual-density.
- Multibus compatible, including 8/16 bit data bus, 24 bit addressing and DMA data transfer.
- Executes over 30 commands including 3 different Read/Write modes.
- Automatic Ring Buffering to simplify the interface to streaming drives.



**CIPRICO**

Formerly Computer Products Corp.

2405 Annapolis Lane  
Plymouth, MN 55441  
Phone: (612) 559-2034

With field-proven installations, the CPC tapemaster is the most powerful Multibus adaptor for 1/2 inch magnetic tape drives available. Call or write today.

\*Multibus Is A Trademark Of Intel Corporation

## Other Peripheral Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
ADES ..... (714) 594-5858	GYPSY	\$1378	11/81	stk	Winchester Disk/Streaming Tape
	SCSI	-	6/83	stk	Disks, Tapes, Printers, Network Host Adapters
Alloy Engineering .....	DMB-1	\$ 850	-	-	Cartridge Tape (Data Electronics)
	TMB-1	\$1000	-	-	½" Tape Drive Controller
AMTEL CO ..... (608) 221-8856	Z10A080	\$ 245 \$ 530*	3/8	stk	PRIAM Winchester Controller
Central Data Corporation .....	B1026	\$ 330	10/82	stk	Cartridge Tape Controller with Winchester interface
(217) 359-8010	B1023	\$ 650	7/82	30da	ANSI Winchester 5¼", 8", 14"
CIPRICO INC. .... (612) 559-2034	TAPE- MASTER	\$1688	8/81	30da	All formatted ½-inch start/stop or streaming magnetic tape drives
	Rimfire 38A	\$1895	80	30da	All PRIAM Winchester Disks and all formatted ½-inch magnetic tape drives.
	Rimfire 38AD	\$1603	80	30da	All PRIAM Winchester Disks
	Rimfire 44	\$1795	4/82	30da	All ANSI-compatible disks and Archive/Cipher ½-inch tape drives
	Rimfire 44D	\$1603	4/82	30da	All ANSI-compatible disks
	Rimfire 44T	\$ 710	6/82	30da	Archive/Cipher ½-inch cartridge tape drives.
	Rimfire 45	\$1895	2/82	30da	All ANSI-compatible disks and all formatted ½-inch magnetic tape drives.
	Rimfire 50	\$2295	*8/83	30da	All SMD and modified SMD drives
	Rimfire 75	\$1745	9/82	30da	All ANSI-compatible disks and 3M HCD-75 ½-inch cartridge tape drives
	Rimfire 75T	\$1130	9/82	30da	3M HCD-75 ½-inch cartridge tape drives
	Pico-Mate	\$1313	10/81	30da	Kennedy 6450/6455 ½-inch start/stop and streaming cartridge tape drives

# Other Peripheral Controllers

Drives Supported	Error Detection Correction	Data Bus (bits)	Address (bits)	Distinguishing Features
4/4	0	-	-	Requires host adapter board GHIA, FPI/O \$328. Interfaces the following disks - ST506, SA1000, Q2000, ANSI, PRIAM.
2/4	*	-	-	Requires SCSI Host Adapter. Full SCSI implementation.
4	-	-	-	Buffered 8086 based; requires 1 slot; 2K standard 8K max. buffer. Compatible with SBC 80/10, 80/20.
-	-	-	-	9-track formatted tape drive controller; Cipher F880 microstreamer.
4	ECC	8	8-24	Provides interface to PRIAM Smart Series of Winchester disk controllers, four RS-232C serial channels and MC 146818 time-of-day clock.
8	CRC	8	24	Archive/Cipher streaming tape controller, IMI "C" Drive Winchester Controller. Conforms to the QIC-02 Interface.
8	CRC	8	24	512byte dual buffering; memory mapped. Full DMA capability on tape and disk. 10Mbits/sec. transfer rate.
8	-	8/16	24	DMA, three read/write modes including auto Ring-buffers, over 30 commands, optional 2K-16K buffer.
4/4	CRC	8/16	24	DMA, programmable sector size defect mapping, dual function on single card.
4	CRC	8/16	24	DMA, programmable sector size defect mapping.
8/4	ECC	8/16	24	DMA, 32-bit ECC programmable sector size, defect mapping, on-board disk/tape data transfers, full set of separate tape commands.
8	ECC	8/16	24	DMA, 32-bit ECC, programmable sector size, defect mapping.
4	-	8/16	24	DMA, ring-buffer read/write commands for easy streaming control, 30 or 90 ips.
8/4	CRC	8/16	24	DMA, programmable sector size, defect mapping, dual function on single card.
4	ECC	8/16	24	Dual DMA, 48-bit ECC programmable sector size, 1 to 1 interleaving, 2MHz DMA transfer ratio, 32K of optional buffer RAM, etc.
8/4	ECC	8/16	24	DMA, 32-bit ECC, programmable sector size, defect mapping, on-board disk/tape transfers, full set of separate tape commands.
4	-	8/16	24	DMA, controls 30 ips or 60 ips tape drives, up to 67Mbytes per cartridge.
2	-	8/16	24	DMA, two read/write modes, $\frac{1}{2}$ " drive appears to user as familiar $\frac{1}{2}$ " drive.

continued next page



## Other Peripheral Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
Comark Corporation ..... (617) 359-8161	MT 80	\$1295	1/79	-	½" Tape Drive
	MT 86	\$1295	12/81	-	½" Tape Drive
Control Data Corporation ..... (612) 853-6687	9090	\$2495	7/83	45da	SMD Disk Drive Controller
Data Systems Design ..... See Sales Office Listing	DSD-7215	\$1395	6/82	30da	8" Winchester, 8" Floppy Disk, ¼" Streaming Tape
	DSD-5215	\$1395	6/82	30da	5¼" Winchester, 5¼" Mini-Floppy, ¼" Streaming Tape
	DSD-6215	\$1495	6/83	30-45da	5¼" Winchester, 8" Floppy Disk, ¼" Streaming Tape
	DSD-5217	\$1495	6/83	30-45da	5¼" Winchester, 5¼" Floppy Disk, ¼" Streaming Tape
	DSD-6217	\$1495	6/83	30-45da	5¼" Winchester, 8" Floppy Disk, ¼" Streaming Tape
	DSD-7217	\$1495	6/83	30-45da	8" Winchester, 8" Floppy Disk, ¼" Streaming Tape
Data Technology Corporation ..... DTC-500	DTC-500	\$-	-	-	5¼" Winchester, 5¼" Floppy Disk
	DTC-700	\$-	-	-	8" Winchester, 8" Floppy Disk ¼" Tape Drives
Distributed Computer ..... (617) 890-8200	DCS/SASI	\$ 750	★10/83	stk	Generic Winchester
	DCS/ISI	\$ 425	★10/83	stk	CDC Native Interface
EMM/Sesco ..... TC1	SECS 80/ TC1	\$3250	-	-	½" Tape Drive
Ikon Corporation ..... (206) 624-3410	10071-5	\$2150	3/82	stk	Multibus-Versatec Plotter/Printer Interface
Intel Corporation ..... See Sales Office Listing	iSBC 220	\$2500	-	-	SMD Disk Controller
	iSBC 215G	\$1500	-	-	ANSI Winchester 5¼", 8", 14"
	iSBX 217B	\$ 495	11/82	-	¼" Cartridge Tape Controller



# Other Peripheral Controllers

Drives Supported	Error Detection Correction	Data Bus (bits)	Address (bits)	Distinguishing Features
8	-	8	-	
8	-	8	-	Full DMA capability, includes cables, specify drive type.
4	ECC	8/16	24	Any mix of 4 SMD interface disks. New ECC handles both run length limited (RLL) and MFM encoding methods. Software drivers available.
5	ECC	8/16	24	<u>5215, 6215, 7215</u>
5	ECC	8/16	24	These three-function Multibus controllers feature high speed non-interleaved Winchester and floppy operation. They have 32-bit error correction, HyperDiagnostics, and on-board data separators. They also support 24-bit addressing, require no drive cable scrambler cards, AND provide back-up oriented QIC2 tape commands.
5	ECC	8/16	24	<u>5217, 6217, 7217</u>
5	ECC	8/16	24	Same as 5215, 6215, 7215 except they provide QIC2 commands for file oriented tape transfers.
5	ECC	8/16	24	
4	P	8/16	24	Requires DTC Host Adapter, +5V only.
5	P	8/16	24	Requires DTC Host Adapter, +5V only.
4	ECC	8/-	24	DMA burst or priority modes also contain micro-floppy and disk controller for any combination totaling 4 floppy drives.
4	ECC	8/16	24	DMA burst or priority modes; floppy disk controller for up to 4 8" drives.
4	CRC	-	-	MIL-Spec.
-	-	8/16	24	8/16/20/24-bit addressing; 8/16-bit data; single or block 400Kbyte/sec DMA; switchable byte ordering; bus and non-bus-vectorized interrupts; parallel or serial priority; TTL and Differential plotter I/O.
4	ECC	8/16	20	High speed SMD interface; 12MB to 2.4GB per controller, on-board diagnostic, ECC, and defective track handling. 8089 I/O processor for 2 DMA channels and controller intelligence.
4	ECC	8/16	24	The 8089 I/O processor provides DMA channels, plus user-programmable intelligence. Back-up provided via iSBX 218 or iSBX 217B modules. On-board diagnostics and ECC.
-	-	-	-	Byte-wide intelligent interface for 1/2" cartridge tape drives; interfaces to both start/stop and streamers from six vendors. HCD-75 start/stop and QIC-02 compatible streaming drives.

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## Other Peripheral Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
Interphase Corporation ..... (214) 350-9600	HDC 1880	\$1795	-	-	Cartridge Disk Controller
	SMD 2180	\$1995	-	-	SMD Disk Drive Controller
	SMD 2181	\$2250	-	-	SMD Disk Drive Controller
	SMD 2190	\$2250	★8/83	30da	SMD Disk Drive Controller
	WDC 2880	\$1895	-	-	ANSI Winchester Disk Controller
	SDC 2203	\$1795	-	-	SASI Disk/Floppy Disk
Konan Corporation ..... (602) 269-2649	TAISHO	\$ 895	7/82	stk	Hard Disk/Floppy Disk Controller
Megalogic Corporation ..... QIM-1/MX	QIM-1/MX	\$ 895	-	stk	Cartridge Tape Controller
	QIM-1/MN	\$ 295	-	stk	Cartridge Tape (mini-cartridge)
	TIM-1/MX	\$ 895	-	stk	Cartridge Tape Controller
Mesa Technology Corporation ..... (800) 638-2039	4100	\$3995	8/82	-	GCR Digital Tape Controller
Metacomp, Inc. .... (619) 578-9840	MPX 2000- 310	\$ 295	3/83	30da	Winchester Disk and Tape Controller
Micro Industries ..... (614) 895-0404	MIB501	\$ 677	-	stk	DMA Controller
Microcomputer Systems ..... MSC-9205	MSC-9205	\$ 795	-	stk	5¼" Winchester Disk Controller
National Semiconductor ..... See Sales Office Listing	BLC 8230	\$1500	-	stk	8" Floppy/Winchester Controller
NEC Electronics U.S.A. .... (617) 655-8833	BP2000	\$-	★9/83	30da	ST 506/412 Winchester Interface

# Other Peripheral Controllers

Drives Supported	Error Detection Correction	Data Bus (bits)	Address (bits)	Distinguishing Features
4	ECC	-	20	+5V only; DMA.
4	ECC	8/16	20	Controls up to four 40-300Mbyte SMDs; DMA.
4	ECC	8/16	24	Transfers a full track in one disk revolution; DMA. +5V only.
4	ECC	8/16	24	Optomized for UNIX. Utilizes cache memory on-board.
8	ECC*	8/16	20	+5V only; ANSI 1226 compatibility.
-	CRC	8	20	Emulates Intel 201, 202 & 206 disk controllers; Appears as a 740 Disk System for ISSIS and CPM. Second source for Zendex ZX-203.
4/2	ECC	8/16	24	Controls up to four 5 $\frac{1}{4}$ " hard disks and two floppies; incorporates error correction, automatic flaw mapping, DMA of commands and data; single board.
8	-	-	-	Quantex 650, ANSI/ECMA compatible.
1	-	-	-	Quantex 200.
4	-	-	-	Tandberg TDC 3000.
1	-	-	-	Single board MULTIBUS compatible interface. Direct connect to industry standard formatter. On-board FIFO minimizes bus latency. 16-bit addressing. 64Kbyte transfers. All DMA with adjustable throttle.
-	-	-	-	SASI Disk interface module for high-performance DMA to any SASI bus disks, including 5 $\frac{1}{4}$ ", 8" Hard Disk and streaming tape drives. Operates with METACOMP MPA-2000 (See Com. Ctlrs. pg. 95)
4	-	8/16	16	DMA Controller addressing up to 65,536 memory locations.
5	ECC	8/16	20	Supports 4 ST-506 and other drives; 512-bit buffer.
4	ECC	8/16	16/24	Single board fully software compatible with iSBX 215, ST 506 type interface, 1 yr. warranty. Optional 5 $\frac{1}{4}$ " floppy/Winchester Model BLC 8232, \$1400.
4/4	ECC/CRC	8/16	24	4/16K dual-ported buffer. DMA transfers between disks and bus disks and buffer, buffer and bus, any two system memories on bus.

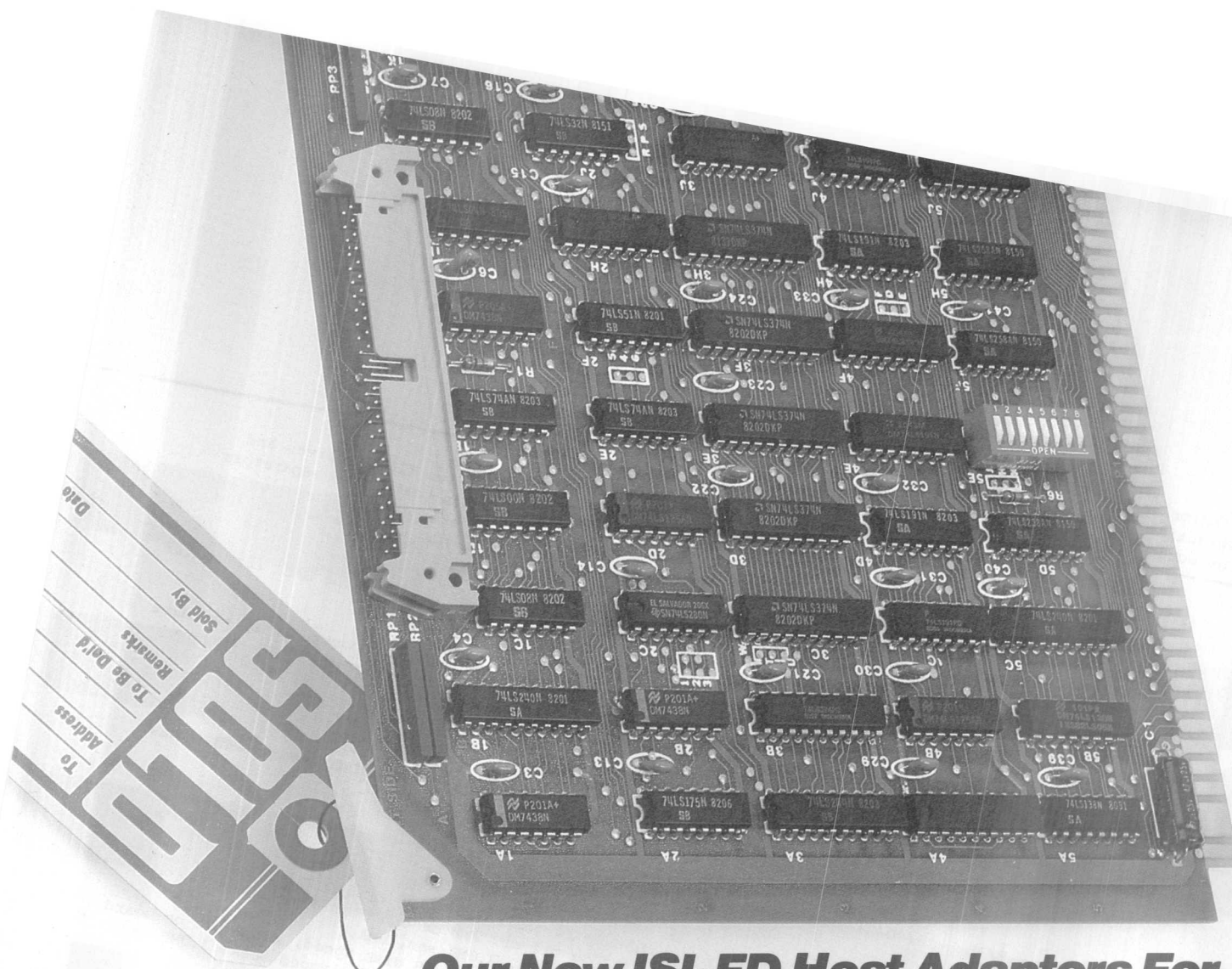
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## Other Peripheral Controllers

Manufacturer	Model	Price	DFA	Deliv.	Type
Scientific Micro Systems ..... (415)964-5700	FWD 8001	\$1500	10/81	30da	Floppy/Winchester Controller
	FWD 8006	\$1400	12/82	30da	Floppy/Winchester Controller
Shugart Associates ..... (617)272-8140	SA 1586	\$-	-	-	Host Adapter for Fixed Disk Controllers
Systech Corporation ..... (619)695-3420	STC-4400	\$ 795	2/82	stk	DMA QIC-02 Cartridge Tape Controller
	MLP-2000	\$ 650	7/82	stk	Dual Printer Controller
	VPC-1000	\$1550	★7/83	stk	Versatec Printer Controller
Xylogics ..... (617)272-8140 (800)225-3317	472	\$1795	6/83	30da	1/2" Tape Drive
	420	\$1320	★12/83	30da	ST506/412 Winchester, QIC-02 Cartridge Tape
	450	\$2295	4/83	30da	SMD Disk Drive



Drives Supported	Error Detection Correction	Data Bus (bits)	Address (bits)	Distinguishing Features
4	ECC	8/16	16/24	Single board; iSBC 215A compatible; supports two floppy drives and two Shugart or Quantum 8" Winchesters; on-board data separator; ECC 32-bit computer generated code.
4	ECC	8/16	16/20/24	Single board; iSBC 215A compatible, supports two 5¼" Winchesters and two 5¼" floppies or two 8" floppies. Direct transfer option; On-board data separator.
-	-	8/16	16/20/24	Single board PCB providing a complete interface with the SASI controller and the Multibus.
4	-	8/16	24	Supports all QIC-02 compatible Streaming Tape transports. As of the date of this publication, the following mfgs' endorse QIC-02 -Archive, Cipher, DEI, Irwin-Olivetti, Qantex, Rosscomp, & Tandberg.
2	-	8/16	24	Supports Centronics or Dataproducts compatible data communications or line printers in high-speed DMA environment. Has on-board self-test, automatic printer configuration and long lines option.
1	-	8/16	24	Supports Versatec printer plotters in high-speed DMA environment - has on-board self-test and long lines option.
4	-	8/16	16/20/24	One board, 800/1600/6250 bpi, 12.5 ips-125 ips, Pertec Interface, supports start/stop drives 2KB or 8KB FIFO buffer, status LED's.
2 Disk 4 Tape	ECC	8/16	16/20/24	Multi-function single board controller supporting 2ST506/412 disks and 4QIC-02 ¼" cartridge drives. 2KB or 8KB FIFO Disk Buffer. 512B Tape Buffer, status LED's, 3.0MB/sec, DMA.
4	ECC	8/16	16/20/24	One board, 2KB or 8KB FIFO buffer, 1.9MB disk speed, automatic on-board ECC correction, status LEDs, implicit overlapped seeks 3.0MB/sec DMA speed.



## **Our New ISI-FD Host Adaptors For Multibus Are Ready. Let's Put Your Name On One!**

*If you're getting ready to use the family of ISI intelligent disks from Control Data, there is good news. Our new ISI Host Adaptor is ready to ship.*

*The ISI Host Adaptor is one of a series of board-level products from Distributed Computer Systems, which has developed a solid reputation in system-level products and engineering. A standard multimaster module, the DCS ISI Host Adaptor offers a surprisingly cost effective way of interfacing whole families of high performance CDC disk drives to a Multibus micro-computer system. In addition, a floppy disk controller is available on board. The unit functions in full DMA burst or bus-exchange priority modes, with 24 bit address and 16 bit data transfers.*

*Call us today for all the details and specs so we can put your name on one or more of our units. Ask for Garry Stephens.*



Distributed Computer Systems  
330 Bear Hill Road  
Waltham, MA 02154  
(617) 890-8200  
Telex: 705745

## Controller Peripheral Subsystems

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ADES

Alloy Engineering

AMTELCO

Central Data Corporation

Ciprico, Inc.

Comark Corporation

Data Management Labs

Data Systems Design

Heurikon Corporation

Interphase Corporation

Mesa Technology Corporation

NEC Electronics U.S.A.

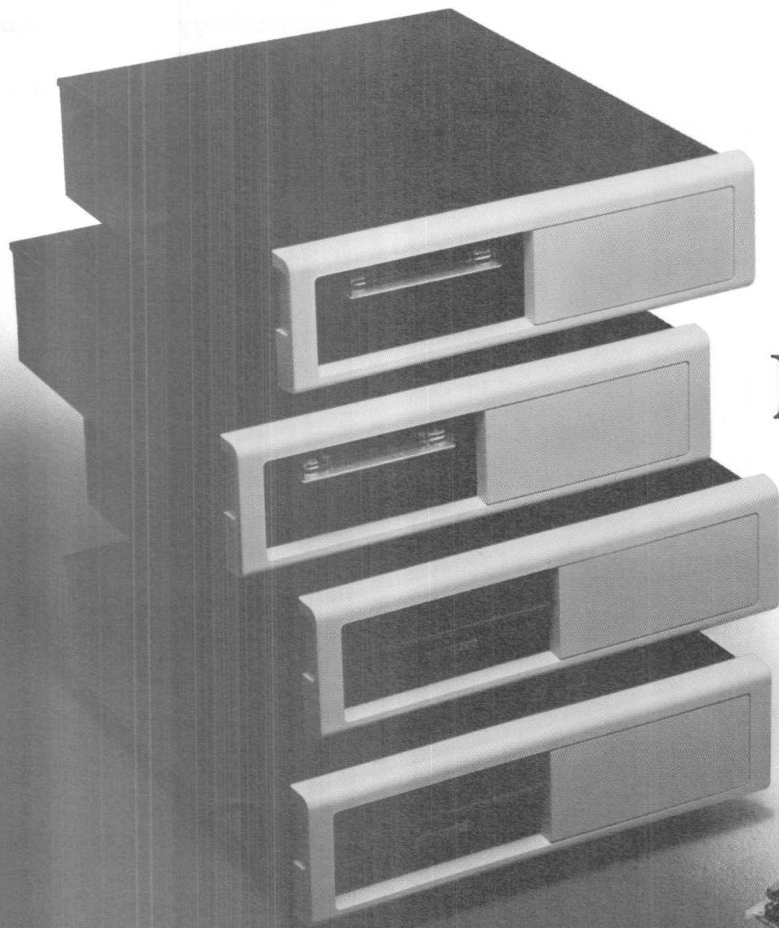
Scientific Micro Systems

Systech Corporation

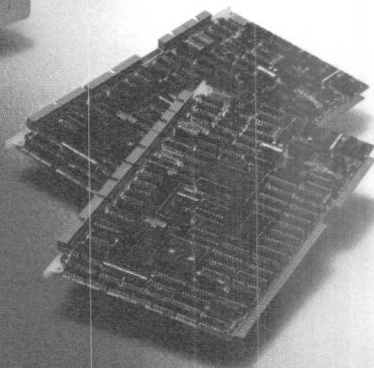
US Design Corporation

Zendex Corporation

**FINALLY,  
MULTIBUS STORAGE SYSTEMS  
DESIGNED WITH THE MOST  
IMPORTANT FEATURE  
YOU CAN BUY.**



**FORESIGHT.**





The Multibus® market is very quietly growing like crazy.

The 16-bit processors are taking off. The applications are getting more complex. And the users are becoming more and more sophisticated.

If you're one of them, it's probably as clear to you as it is to us that you're going to need high performance disk systems designed to accommodate your future growth.

Rather than make you wait until the last minute, here they are.

### **Presenting the 770 Multibus Storage Systems from Data Systems Design.**

The DSD 770 Multibus storage systems offer you the kind of flexibility and performance you'll need, not only now, to get your product to market quickly, but also later, to keep pace with your growing needs.

The systems come in four basic configurations: An 8" 10 Mb or 40 Mb Winchester with either a 1/4" streaming tape for back-up, or a 1 Mb floppy for low cost software distribution. All competitively priced.

And they all fit nicely into a 19" rack because each system is only 5 1/4" high.

But the real magic comes courtesy of our new multi-function Multibus controller/interface.

### **Multiple choice on one Multibus board.**

Our new controller/interface contains a Winchester disk interface that will handle two drives of up to 40 Mb each. An interface for 1/4" streaming tape. And a floppy drive interface that can control two 1 Mb floppy drives.

Plus data separation.

32-bit ECC for high reliability.

Automatic self-test. Self diagnostics.

Full compatibility with IEEE 796 standards.

Intel® iSBC® 215 and iSBX™ 218 emulation.

24-bit addressing.

A high speed internal bus and pipelined architecture with a dual port buffer to move data at non-interleaved speeds. And a read/write sequencer to go with it that's capable of running faster than any 8" Winchester drive likely to come along for a long time.

But here's the kicker. All this takes up just one slot in your Multibus backplane because it all comes on just one board.

And for those of you with unique packaging requirements, our controller/interface board is also available by itself, for 8" or 5 1/4" disk drives.

### **Hindsight will prove you right.**

We don't expect you to buy systems with an eye to the future without looking into service and support.

But this is one area we were unable to improve upon. Because we decided we should offer the same kind of efficient service and intelligent support that's made us a leading storage system supplier in the DEC®-compatible market.

That kind of service includes our exclusive on-board HyperDiagnostics™. Remote diagnostic assistance. Rapid Module Exchange™. And the most comprehensive, yet inexpensive extended service program in the business: HyperService™, now with guaranteed twenty-four hour or less module swap.

All backed by support which, according to our customers, is second to none.

### **It pays to plan ahead.**

Given the opportunity all this presents, you're probably going to want to know more about the 770's. And the new Multibus controller/ interface that goes with them.

We can supply you with a comprehensive twelve-page data sheet, that tells you everything you need to know about both, and it's yours for the asking.

So call us today.

Better yet, call us yesterday.

The way things are going, it's already tomorrow.

Corporate Headquarters: 2241 Lundy Avenue, San Jose, CA 95131. Eastern Region Sales and Service: Norwood, MA, (617) 769-7620. Central Region Sales and Service: Dallas, TX, (214) 980-4884. Western Region Sales: Santa Clara, CA, (408) 727-3163. International Sales: San Jose, CA, (408) 946-5800.

## **DATA SYSTEMS DESIGN**

**INTERNATIONAL SALES:** Australia 03/544 3444; Belgium and Luxembourg 02/7209038; Canada 416/625 1907; Denmark 02/63 22 33; Finland 90/88 50 11; France 03/411 5454; Hong Kong and Peoples Republic of China 03/696231; Israel 52-52444; Italy 02/4047648; Japan, Osaka 06/323 1707, Tokyo 03/345 1411; Netherlands 02977-22456; New Zealand 04/693 008; Norway 02/78 94 60; Singapore, Malaysia, and Indonesia 2241077; Spain 01/433 2412; Sweden 08/38 03 70; Switzerland 01/741 41 11; United Kingdom 7073/34774; West Germany and Austria 089/1204-0; Yugoslavia 61/263 261

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# Controller Peripheral Subsystems

Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Mbytes)	Controller
ADES ..... (714) 594-5858	System 14	-	-	-	14" Winchester/ Streaming Tape Subsystem	154/20	GYPSY host intfc.
	System 8	-	-	-	8" Winchester/ Streaming Tape Subsystem	70/20	GYPSY host intfc.
Alloy Engineering .....	DMB-1	\$2650	-	-	Cartridge Tape Subsystem	13.4	DMB-1
	TMB-1	\$4750	-	-	9-Track Tape Drive Subsystem	-	TMB-1
AMTEL CO ..... (608) 221-3856	220A009	-	3/82	stk	8" Winchester Floppy/ 1/4" Streaming Tape*	165	ECC
Central Data Corp. .... (217) 359-8010	D2000	\$2360	1/82	30da	Dual 8" Floppy	1-2	B1015
	D3003	\$8225	11/82	30da	8" ANSI Winchester	35	B1023
Comark Corporation ..... (617) 359-8161	MF80-S/DD	\$3395	7/81	-	Dual Floppy Disk Subsystem	.6/.6	MF 80
	MF85-D/DS	\$3495	7/81	-	Dual Floppy Disk Subsystem	1.2/1.2	MF 85
	MT 80-XXXX	\$-	1/79	-	1/2" Magnetic Tape Subsystem	-	MT 80
	MT 86-XXXX	\$-	12/81	-	1/2" Magnetic Tape Subsystem	-	MT 86
	MT 85-3M	\$2950	7/81	-	Cartridge Tape Subsystem	12	-
	MW 18	\$3995	4/82	-	5 1/4" Winchester Subsystem	18	MW 86
CIPRICO INC. .... (612) 559-2034	TOP-80	\$-	3/83	30da	1/2" Tape Drive Subsystem for CPM/CPM86 system	-	all 1/2"
	-	\$-	1/80	45da	Universal Disk or Tape Subsystems	10/160 16/80	Various

# Controller Peripheral Subsystems

Drive	H"	W"	Enclosure D"	Rackmount	Table-Top	Distinguishing Features
-	9.75	17	23	-	o	CP/M, MP/M, CP/M86 Turbo Dos, others available.
-	9.75	17	23	-	o	CP/M, MP/M, CP/M86 Turbo Dos, others available.
DEI	5.25	19	-	o	-	
Cipher F880	-	-	-	o	*	Includes controller; tape drive; cables and software.
PRIAM	7	19	22	o	o	Controls double sided, double density 8" floppy. Smart ECC controller.
Tandon	10.5	16.75	22.75	*	o	2 or 4 drives, single or double sided.
PRIAM	10.5	16.75	22.75	*	o	Capacities of up to 70M available.
Shugart 801R	5.21	17.4	22.63	*	o	Dual floppy 8" disks; p/s; fan/Intel format.
QUME	5.21	17.4	22.63	*	o	Dual 8" floppies, IBM format, expandable to 4 drive system.
Digidata	-	-	-	o	-	Tape drives and formatters; 11 models.
Digidata	-	-	-	o	-	11 models, includes formatter, cables, software drivers.
3M	4.6	8.6	14.2	*	o	
Disktron	4.6	8.6	14.25	*	o	Expandable to 36Mbytes, chassis fits 8" form factor for easy integration.
-	-	-	-	-	-	Tape subsystem includes CPC Tapemaster, tape drive, cables and TOP/CPM86 Tape Utility.
Various	-	-	-	-	-	CPC subsystems are available as OEM pieces in varying capacities and configurations dependent on vendor preferred peripherals and controller.

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## Controller Peripheral Subsystems

Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Mbytes)	Controller
Data Management Labs .....	1010	\$6900	12/82	-	Winchester/Floppy Subsystem	5.7	-
	1011	\$5900	6/82	-	8"Winchester Subsystem	3.6	-
	1040	\$9200	6/82	-	Winchester/Floppy Subsystem	26.2	-
	1041	\$8200	6/82	-	Winchester Subsystem	25.2	-
Data Systems Designs ..... See Sales Office Listing	DSD 770- T10	\$8375	6/82	30- 45da	Winchester/1/4" Streaming Tape Subsystem	10/20	DSD 7215
	DSD 770- T40	\$10479	6/82	30- 45da	Winchester/1/4" Streaming Tape Subsystem	40/20	DSD 7215
	DSD 770- F10	\$6895	6/82	30- 45da	Winchester/Floppy Subsystem	10/1	DSD 7215
	DSD 770- F40	\$8995	6/82	30- 45da	Winchester/Floppy Subsystem	40/1	DSD 7215
	DSD 770- F80	\$-	★7/83	30- 45da	Winchester/1/4" Streaming Tape Subsystem	8/1	DSD 7215



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## Controller Peripheral Subsystems

Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Mbytes)	Controller
Heurikon Corporation ..... (608) 271-8700 (800) 356-9602	MLZ-FW-R101	\$4995	-	-	Winchester/Floppy Subsystem	10	-
	MLZ-FW-R202	\$5895	-	-	Winchester/Floppy Subsystem	20/-	-
	MLZ-FW-402	\$7045	-	-	Winchester/Floppy Subsystem	40/-	-
	MLZ-W01-R10	\$4195	-	-	Winchester Subsystem	10	-
	MLZ-W01-R20	\$4895	-	-	Winchester Subsystem	20	-
	MLZ-W01-R40	\$5995	-	-	Winchester Subsystem	40	-
	MLZ-W01-R80	\$10115	-	-	Dual Winchester Subsystem	80	-
	MLZ-ARC	\$2995	-	-	Streaming Tape Subsystem	20	-
	MLZ-AW-R20	\$6995	-	-	Winchester/Streaming Tape	20/20	-
	MLZ-AW-R40	\$7995	-	-	Winchester/Streaming Tape	40/20	-
Interphase Corporation ... (214) 350-9000	HDC1880WD-10	\$7995	-	-	Cartridge Disk Subsystem	10	HDC 1880
	WDS 200	\$7550	-	stk	Winchester Disk Subsystem	8	SMD 2180
	WDS 201	\$7850	-	stk	Winchester Disk Subsystem	24	SMD 2180
	WDS 230	\$6995	-	-	Winchester Disk Subsystem	16	SMD 2180
	WDS 210	\$6025	-	stk	Winchester Disk Subsystem	10	WDC 2880
	WDS 211	\$6450	-	stk	Winchester Disk Subsystem	20	WDC 2880
	WDS 212	\$9725	82	-	Winchester Disk Subsystem	60	WDC 2880

# Controller Peripheral Subsystems

Drive	H"	W"	Enclosure D"	Rackmount	Table-Top	Distinguishing Features
-	5.25	19	21	o	*	Same as R101 except 20M Winchester, (DS, DD only).
-	5.25	19	21	o	*	Same as R101 except 40M Winchester, (DS, DD only).
-	5.25	19	21	o	*	Winchester hard disk; includes controller; p/s front panel; all internal cables.
-	5.25	19	21	o	*	Same as R10 except 20M Winchester.
-	5.25	19	21	o	*	Same as R10 except 40M Winchester.
-	5.25	19	21	o	*	
-	5.25	19	21	o	*	
-	-	-	-	o	*	
-	5.25	19	21	o	*	
-	5.25	19	21	o	*	
Western Dynex	7	19	21	o	*	Includes drive, cables, terminator block, controller.
BASF	7	19	21	o	*	Includes SMD option.
BASF	7	19	21	o	*	Includes SMD option.
CDC	-	-	-	-	-	Includes SMD option.
3M	7	19	21	o	*	Includes ANSI option.
3M	7	19	21	o	*	Includes ANSI option.
3M	7	19	21	o	*	Includes ANSI option.

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## Controller Peripheral Subsystems

Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Mbytes)	Controller
Mesa Technology Corporation ..... (800)638-2039	4001	\$10340	3/83	-	Digital Tape System	-	4100
	4000	\$33950	8/82	-	GRC Digital Tape System	-	4100
	4002	\$6445	3/83	-	1/2" Streaming Tape System	-	included
NEC Electronics U.S.A. .... (617)655-8833	SP0965	\$4495	3/82	30da	Dual Floppy Disk Subsystem	1.2/1.2	BP2190*
Scientific Micro Systems ..... FWT8017X	FWT802X	\$3900	12/81	30da	Dual Floppy Disk Subsystem	1.2/1.2	FWD 8001
		\$6800- 9500	12/81	30da	Winchester/Floppy Subsystem	1.2/to 75.4	FWD 8001
Systech Corporation ..... (619)695-3420	STC 4420	\$2950	2/82	stk	Cartridge Tape Subsystem	20	STC-4400
	STC 4440	\$3025	2/82	stk	Cartridge Tape Subsystem	40	STC-4400
	STC 4460	\$3100	★7/83	stk	Cartridge Tape Subsystem	60	STC-4400
U.S. Design Corporation ..... CSS-800		\$6245	4/83	-	Winchester/1/4" Cartridge	17	8016



# Controller Peripheral Subsystems

Drive	H"	W"	Enclosure D"	Rackmount	Table-Top	Distinguishing Features
9-trk	-	-	-	o	-	Choice of 45 ips, 75 ips, and 125 ips Models. Fully ANSI/IBM compatible. iRMX-86 compatible software driver. Includes Multibus compatible controller & cables.
-	-	-	-	*	o	Tridensity: GCR 6250, PE 1600, NRZI 800 BPI. 128 ips vacuum column transport. Interchangeable with ANSI/IBM Systems. iRMX-86 compatible driver.
-	-	-	-	*	o	Fully automatic loading of $\frac{1}{4}$ " ANSI standard 9-track tape. 25/100 ips operation at 1600 bpi data density. Buffered/direct data transfers, includes streaming tape.
NEC FD-1160	7.2	19.2	22.1	-	o	Table-top, 2-8" disk drives, power supply, dual cooling fans, front panel indicators, mounting space for interface connectors.
Shugart SA850	5.25	19	21	*	*	Compatible with iRMX-86. Includes FWD8001 controller, two drives, enclosure, power, and cooling. Rack or desk top.
Quantum Shugart	5.25	19	21	*	*	Winchester/Floppy storage system using FWD8001 controllers; includes enclosure, power, one double-sided floppy drive and 8" Winchester with up to 75.6Mbyte storage.
QIC	5.5	9.5	20.5	*	o	$\frac{1}{4}$ " streaming tape subsystem; includes enclosure, cabling, power supply, and UNIX software.
QIC	5.5	9.5	20.5	*	o	$\frac{1}{4}$ " streaming tape subsystem; includes enclosure, cabling, power supply, and UNIX software.
QIC	5.5	9.5	20.5	*	o	$\frac{1}{4}$ " streaming tape subsystem; includes enclosure, power supply, and UNIX software.
-	5.5	17	22.5	*	o	

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## Controller Peripheral Subsystems

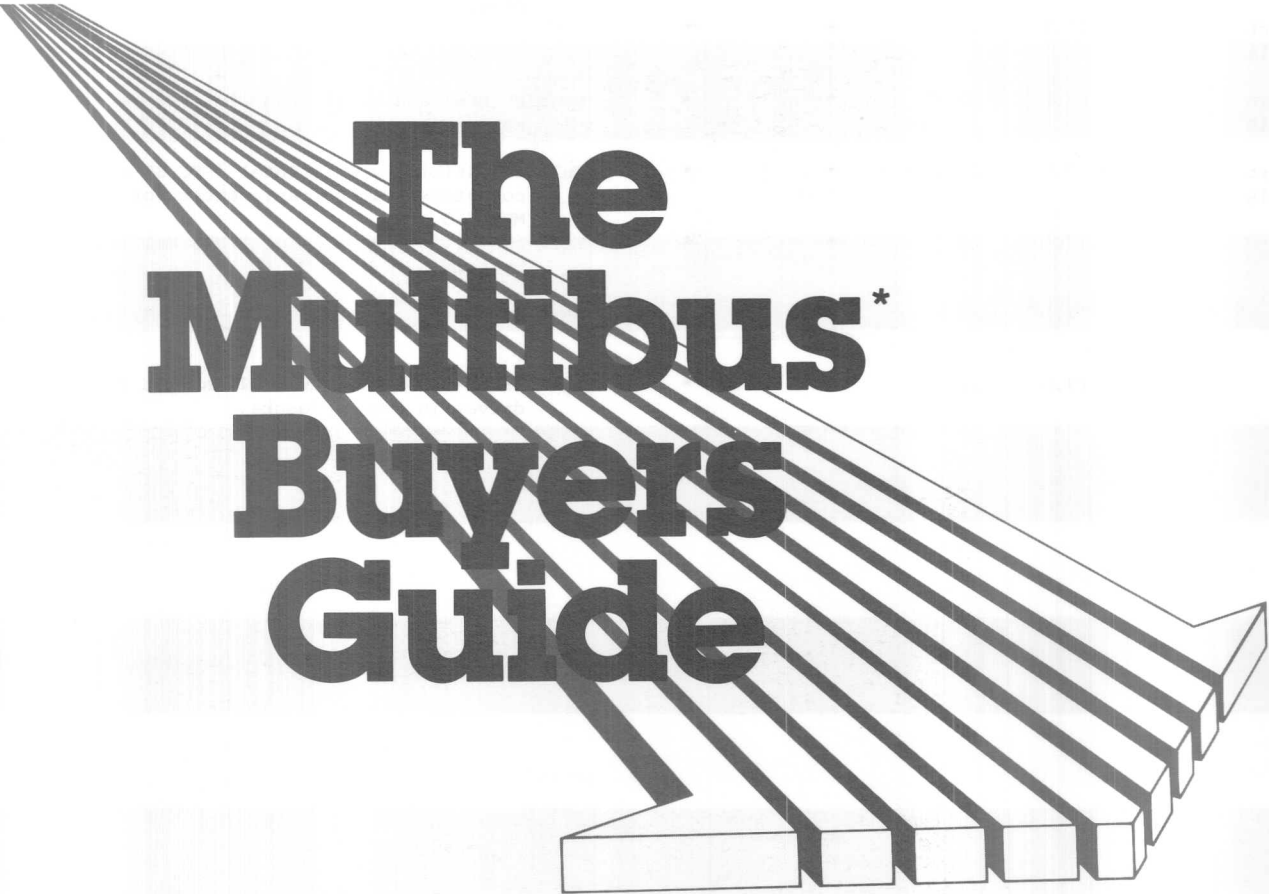
Manufacturer	Model	Price	DFA	Deliv.	Type	Capacity (Mbytes)	Controller
Winchester System Inc. .... (617)933-8500 (800)325-3700	DataSafe 8/812	\$8995	5/83	15- 30da	5¼" Fixed and 5¼" Removable Winchester Cartridge	8/8 16/16*	-
	DataSafe 8	\$4995	4/82	15- 30da	5¼" Winchester	8 16/24*	-
	DataSafe 17R	\$9500	12/82	30- 45da	8" Removable Winchester Cartridge	17 34*	-
Zendex Corporation ..... (415)828-3000	ZX-705A	-	-	2wk	Dual Floppy Disk Subsystem	.6/.6	ZX-204
	ZX-708	\$3450	9/81	2wk	Dual Floppy Disk Subsystem	.5/.5	ZX-208
	ZX-710/ 720	\$3950	10/80	2wk	Dual Floppy Disk Subsystem	.5/.5	ZX-200A
	ZX-740- 10C	\$7550	3/83	2wk	Winchester Driver	10	ZX-203
	ZX-740- 20C	\$9150	3/83	2wk	Winchester Driver	20	ZX-203
	ZX-740- 21C	\$8995	3/83	2wk	Winchester and Floppy	10/1	ZX-203

Drive	H"	W"	Enclosure D"	Rackmount	Table-Top	Distinguishing Features
-	5.25	16.9	17.5	o	o	93-second duplication eliminates floppies and streaming tape. Choice of interfaces. Multibus or ISIS II for Intellec II, III or MDS-800.
-	5.25	16.9	17.5	o	o	Industrial quality. Choice of interfaces. Multibus or ISIS II for Intellec Series II, III or MDS-800.
-	6.3	13.5	19.0	-	o	Direct cartridge to Cartridge duplication. ISIS II interface for Intellec Series II, III and MDS-800 only.
Shugart SA-801A	7.25	17.5	20.3	*	*	
Shugart SA-801A	7.25	17.5	20.3	*	*	Double (MFM) and single density (FM) formats. 19" rack mountable.
Shugart SA-801A	7.25	17.5	20.3	*	*	Full compatibility with Intel iSBC 80 and MDS Multibus computers. Direct replacement for Intel MDS-710 and MDS-720.
-	7.25	17.5	20.3	*	*	Full compatibility with Intel MDS Multibus Development Systems.
-	7.25	17.5	20.3	*	*	Same as above with double the capacity.
-	7.25	17.5	20.3	*	*	Same as ZX-740-1 plus two half-height floppy disk drives in one enclosure.



**IRONOAK COMPANY**

3239 Caminito Ameca  
La Jolla, CA 92037  
(619) 450-0191



# **The Multibus<sup>\*</sup> Buyers Guide**

Ironoak publishes:

The Multibus<sup>\*</sup> Buyers Guide  
The VMEbus Buyers Guide  
The STD BUS Buyers Guide  
The S-100 BUS Buyers Guide



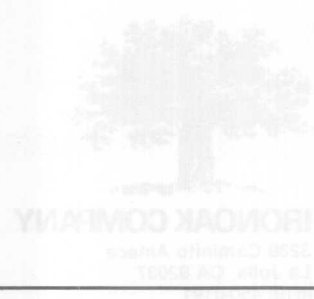
# Voice Synthesis/Recognition

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BECO  
Centrigrum Corp.  
General Digital Corp.  
Intel Corporation  
Microvoice Systems Corp.  
National Semiconductor Corp.  
Speech Plus, Inc.

## Voice Synthesis/Recognition

Manufacturer	Model	Price	DFA	Deliv.	Type
BECO .....	PWB-103	\$ 275	-	-	Speech Output
Centigram Corp. .... (408) 734-3222	LISA <sup>TM</sup>	\$2450	-	-	Speech Output Card
	TIM	\$ 650	-	-	Voice Synthesizer Module
General Digital .....	GDX-SPEECH	\$ 285	10/82	stk	Voice Synthesis
(203) 528-9041	TI				
Intel Corporation .....	iSBC570	\$4900	9/82	-	Speech Transaction Development Set
See Sales Office Listing					
	iSBC576	\$2900	9/82	-	Speech Transaction Board
	Speech Workshop	\$ 795	-	-	Intel Microcomputer Workshop
Microvoice Systems Corp. .... (714) 859-1091	MVB2022	\$1200	★10/83	-	Speech Synthesizer
National Semiconductor .....	BLX-281	\$ 180	-	stk	Voice Synthesis
See Sales Office Listing					
Speech Plus, Inc. .... (415) 964-7023	SP 1000	\$1200	2/81	2wk	Voice Synthesis
	SP 1100	\$1600	10/81	2wk	Voice Synthesis
	PR 2000	\$3500	4/82	-	Voice Synthesis



### Distinguishing Features

Provides 274 words of preprogrammed speech used in process control and quality control applications.

Compatible with Multibus compatible Voice Ware<sup>TM</sup> Development Systems developed by Centigram.

SBX-compatible, incorporates TI 5220 Speech Processor.

Complete speech synthesizer Expansion Module for natural sounding voice. Uses TI 5220 chip, LPC-10 techniques. Interchangeable on-board vocabulary ROM, filter, 2W amplifier, volume control.

Easy-to-use package for speech transaction evaluation, application design simulation and application development.

Provides Automatic Speech Recognition (ASR) function. Includes ROM-resident Speech Transaction Manager.

Introduction to speech communication with computers; Speech transaction development methodology; speech performance evaluation.

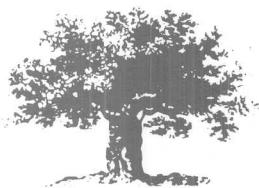
Speech synthesizer and digital sound record/playback board; 8 min. of speech; 1 min. of ADPCM speech/sounds. 2½ watt amplifier, 600 ohm audio output.

SBX MULTIMODULE, 144 word vocabulary.

Complete voice synthesizer capable of producing natural life-like speech quality; large vocabulary storage; up to 458Kbits; typically 200 to 300 seconds of speech.

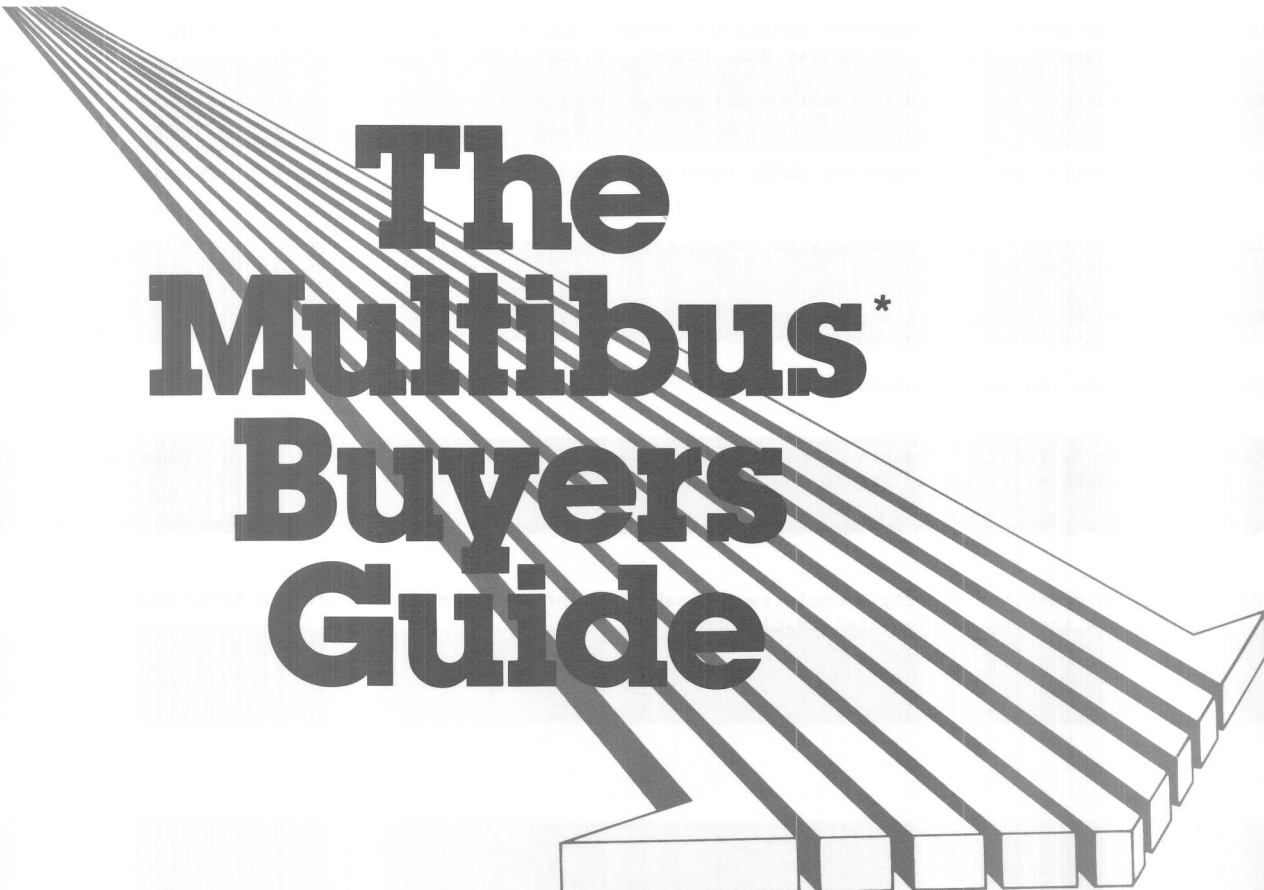
Similar to Speech 1000 except encoded (LPC) human speech is downloadable into RAM; typically 30 seconds of speech.

Text to speech converter clearly enunciates English words or sentences by converting ASCII coded text into allophones then to highly intelligible speech.



**IRONOAK COMPANY**

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A graphic consisting of numerous parallel lines that converge from the left towards the right, creating a strong sense of perspective. At the bottom right, these lines form the shape of a large, three-dimensional arrow pointing towards the right.

# **The Multibus<sup>\*</sup> Buyers Guide**

Ironoak publishes:

- The Multibus<sup>\*</sup> Buyers Guide
- The VMEbus Buyers Guide
- The STD BUS Buyers Guide
- The S-100 BUS Buyers Guide



# Industrial I/O

AMD  
Astrpsystems, Inc.  
BECO  
Burr-Brown  
Compumotor Corporation  
Controlsmith, Inc.  
Delta Tau Data Systems, Inc.  
Distributed Computer Systems  
Electro Craft, Inc.  
Megalogic Corporation  
North Coast Automation, Inc.  
Northern Precision Laboratories, Inc.  
Opto 22  
Ormec Systems Corporation  
Toko America, Inc.  
Xybergraphics, Inc.

# Industrial I/O

Note: See Parallel/Serial I/O for industrial grade parallel I/O

Manufacturer	Model	Price	DFA	Deliv.	Type
AMD ..... (408)988-7777	94/1541	\$ 395	*9/83	stk	Stepper Motor Controller
Astrosystems Inc. .... (516)328-1600	BMUT	\$ 995	-	-	Position Digitizer
BECO ..... 	PWB-100	\$ 375	-	-	Thumbwheel Switch Panel
	PWB-101	\$ 285	-	-	Pushbutton Panel
	PWB-102	\$ 295	-	-	Digital Display Panel
Burr-Brown ..... (602)747-0711	MP820-5	\$ 350	6/82	-	Pulse Accumulator, 5-channel
	MP821-5	\$ 400	6/82	-	Pulse Accumulator, Duration or Frequency
	MP801	\$ 335	-	-	Discrete Reed Relay Output
	MP810	\$ 410	-	-	Discrete Optically Isolated Input
Compumotor Corporation ..... (707)778-1244 (800)358-9068	1810	\$1095	3/83	-	Motor Controller, Open Loop
	1811	\$1450	6/83	-	Motor Controller, Closed Loop
Controlsmith, Inc. .... 	Smart Motion	\$2500	80	30da	Motion Control, CPU
	PS-10	\$ 650	78	stk	Positioning Servo Interface
	PS-20	\$ 795	80	stk	Positioning Servo Interface
	PS-25	\$ 725	80	stk	Stepping Motor Interface
Delta Tau Data Systems Inc. .... 	MC <sup>2</sup>	\$1100	*9/83	stk	Servo Position, Closed Loop
	MC <sup>2</sup> EX	\$ 395	1/83	stk	Multimodule Axis Expander

## Distinguishing Features

- Full control and feedback for 1 4-phase stepper motor; includes 15 lines of feedback (single-width SBX Module).
- Astrosystems' series BMUT Absolute Encoders measures a shaft position and provides a binary output equivalent to shaft angle. The rugged transducer is mechanically coupled by the user to machinery and instruments of all types to allow the computer to continuously monitor the physical movements of one or more axes of motion. Up to 16 switches per panel.
- 8 lighted pushbuttons.
- One six-digit, two five-digit displays.
- 5-channel; optically isolated; for pulse counting (accumulation) and pulse width (period) measurement; debounce circuit; 4 to 48 VDC @ 1.5mA; 64K counts 16-bit; optional 15-channel version.
- 5-channel, 16 bits, 1500 VDC isolation, 4-48 VDC closure detection; single +5V supply; 10KHz bandwidth; optional 15-channel version.
- 16 isolated relay outputs (optional 32 outputs); 0.5A at 28 VDC.
- 24-channel dry contact closure; optional DC voltage level, 17 to 84 VDC; low DC voltage level, 1 to 5 VDC; AC voltage level 65 to 250 VAC.
- Driver standard stepping motor translators and Compumotor's high precision microstepped motor/drives. On-board 5MHz 8088 processor. 75 commands and may be I/O or memory mapped.
- Incorporates 1810 command set, defines the target system's encoder and motor resolution over the Multibus.
- Provides up to 8 axes of continuous-path motion control for use with PS-20 and/or PS-25 boards.
- Positioning servo interface to any velocity-servo-driven positioning axis with incremental encoder feedback.
- Two-axis, closed-loop-servo interface. Note: Controlsmith offers 20% to 40% discount to O.E.M. customers.
- Two-axis stepping motor interface.
- N.C. & Robotics Control Board, expands to 16 axis. Controls DC servo amp/motor or stepper motor, encoder feedback. Operates stand alone or as slave to master CPU.
- Two axis expansion iSBX Multimodule for MC<sup>2</sup>.

continued next page

# Industrial I/O

Note: See Parallel Serial I/O Expansion for industrial grade parallel I/O

Manufacturer	Model	Price	DFA	Deliv.	Type
Distributed Computer ..... (617)899-6619 (800)225-4589	DIGSYN-1	\$1500	-	-	Digital to Synchro
	SYNDIG-1	\$1200	-	-	Synchro to Digital
	DCS/PS/80	\$1200	-	-	Positioning Servo
	DCS/STEP2	\$1200	-	-	Stepping Motor Interface
Electro Craft Inc. .... (612)931-2700	PROPOS	\$2500	4/83	3-6 mos.	ServoMotion Control Board
Megalogic .....	SUE-I/O	\$ 345	-	2wk	Relay, I/O Port Module
North Coast Automation ..... (216)729-2200	9702	\$ 775	81	stk	Dual Industrial Motor Control
Northern Precision Laboratories ..... (201)227-4800	NPC 1102	\$ 980	-	4wk	11-bit Absolute Servo Controller
	NDI 1400	\$2700	-	4wk	14-bit Resolver Input Board Set
	NPC 1103	\$ 980	-	4wk	11-bit Digital Control Transformer
	NPC 1300	\$ 750	-	4wk	Multi-channel 13-bit D/A
Opto 22 ..... (714)891-5861	Power I/O	\$-	-	-	Optically Isolated Power Switching
Ormec Systems Corp. .... (716)385-3520	PRG-900	\$1345	4/82	2-5 wk	Programmable Reference Generator
Toko America, Inc. .... (312)677-3640	NCB102-1	\$2660	-	stk	Two-Axis Control Module
	NCB102-2	\$3150	-	stk	Multi-Axis Control Module
	NCB102-3	\$1550	-	stk	Axis Expansion Module
Xybergraphics Inc. .... (415)965-7976	Axis III	\$-	-	-	Multi-Axis Stepper Motor Controller



## Distinguishing Features

3-3 line digital to synchro outputs; 12-bit resolution.

3-3 line synchro inputs.

Interfaces to velocity servo driven positioning axis with incremental encoder feedback.

2 independent stepper motor interfaces with opto-isolation.

Board is programmable.

Up to 8 optically isolated relays; each relay fused at 5A, up to 240V.

Compatible with 8 or 16-bit; can be used to control or measure position, velocity or tension; encoder 16-bit counter; single ended or differential inputs; two axes per board. Optional 12-bit DAC; 16-bit DAC; on-board +15V.

Optional 16-bit. 10-bit D/A output  $\pm 10V$ . Single axis. Multiple axis using additional boards. Multiplexed input, Motor current, Tachometer, R/D error voltage. Software available.

Optional 16-bit (single board) and 22-bit (dual board). Multispeed, Multichannel (Contact factory for details). 14-bit successive approximation R/D converter.

Optional 16-bit model 1603 - \$1300. On-board binary rate generator and feed forward D/A output  $\pm 10V$ . Controls position and velocity.

Output channel expandable to 6 per card. I/O addressable. Discrete servo enables and resets signal. Output voltage  $\pm 10.24V$ .

Switch (up to 1024 channels) 120/240 VAC or 60 VDC at 3 amps; Direct cable connection to Multibus or Model 519 expander.

Through a differential parallel interface-commands Ormec Motor Loop Controller to control velocity and/or position.

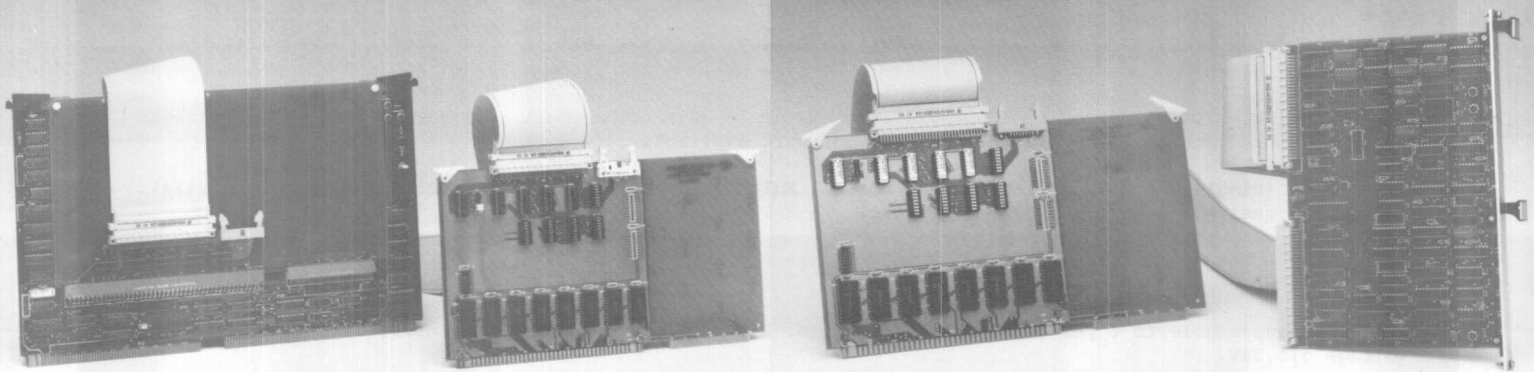
The Numerical Control and Robotics Control Board, the NCB102, produces the interpolation signal to drive the DC servomotor or the stepping motor, and monitors the servo motor by receiving the error pulse.

Expansion up to four axes is capable by combining with the axis expansion module.

Used together with multi-axes control module.

Will drive electromechanical systems using up to 3 stepper motors. Optional 8086/8087 Multibus host. Primary interface is RS-232. Space slots available for additional memory.

# TWO WAYS TO GET TO 32-BIT PERFORMANCE



## MULTIBUS TO VERSAbus

- Designed for minimum installation labor—set 3 Hex switches and 1 header and most Multibus™ Systems are ready for operation in the VERSAbus™.
- Conforms to a VERSAbus spec M68KVBS (D4) and INTEL MULTIBUS spec. Rev.—03, 4/81.
- Master, Slave, Master/Slave operation.
- Buffered Address and Data busses with 48 ma. drive.
- VERSAbus —“Address modifier” bus is encoded & decoded using inexpensive proms—Board easily upgradable to new “A.M.” Assignments.
- Supports VERSAbus 24 Bit Addressing with 3 user selectable options:
- Full parallel 5 Level user selectable (Hex Dip Switch) VERSAbus priority.
- Auto-matic Byte swapping, user defeatable.
- Supports all 7 priority Levels of VERSAbus and Multibus Vectored Interrupts.
- User Alterable Strobe Delays are factory preset for maximum performance.
- Unused VERSAbus and Multibus lines are brought to a .100 x .100 stripline for user configuration.

## MULTIBUS TO VMEbus

- Distributed Processing
- BI-DIRECTIONAL Bus Mastership
- User selectable VMEbus Priority
- Supports 20 or 24 BIT MULTIBUS Addressing
- Buffered Address and Data busses with 64 ma. drive
- Worst Case 200 ns TOTAL thru-put delay (down and back)
- Conforms to VMEbus spec. M68KVMEB(D2) (Motorola)
- With or without BUS SWITCHING



### HAL-VERSA ENGINEERING, INC.

18597 Paseo Tierra  
Saratoga, CA 95070  
(408) 374-2953

MULTIBUS™ trademark INTEL Corp.  
VERSAbus™ trademark MOTOROLA Corp.

## Other Functions

---

AMD  
AIM Technology  
Alligator Computer Products  
AMTELCO  
Bit-3 Computer Corporation  
Digital Pathways, Inc.  
Distributed Computer Systems  
DSP Systems Corporation  
EG&G Reticon  
ETI Micro  
Hal-Versa Engineering, Inc.  
Ikon Corporation  
LeCroy Research Systems Corp.  
Linear Systems, Ltd.  
Marinco, Inc.  
Measurement Systems & Controls  
Medinova Corporation  
Mesa Technologies Corp.  
Micomp Development Corporation  
Micro Designs  
Micro/Sys, Inc.  
Monolithic Systmes Corp.  
Morrow Computer  
National Semiconductor Corp.  
Northern Precision Laboratories Inc.  
Procise Corporation  
Proteon Associates, Inc.  
R & D Electronics  
Silicon Control  
Sky ComputersTITN, Inc.  
Zendex Corporation



# If Numbers Have Your Micro In A Crunch

## Make Short Work Of Long Problems With Marinco's New Array Processor

Now you can solve complex mathematical problems on your micro not in minutes, but in seconds.

The Marinco APB-3024 array processor achieves speeds up to 8 million operations per second. And it

leaves the host computer free for other important work.

The array processor plugs directly into your Multibus. Without fuss. And takes up only a single slot.

To the host, it looks like 64K of extra memory. With memory mapping, it's easy to access.

The processor has both fixed point and full floating point capabilities.

Data flows to and from the board either through dual port memory or through the auxiliary high speed I/O

port. Cycle stealing and simultaneous access of data can also be accomplished.

It can be ordered with standard algorithms in PROM. Or as a programmable version with RAM in program memory.

And behind this new array processor is a staff of engineers and programmers that offer, as needed, comprehensive hardware and software support.

The APB-3024 is fast enough for real-time analysis, versatile enough to handle almost any algorithm and simple enough to talk with easily.

Which is why the processor is in demand for military applications such as radar processing, simulation and C3 analysis.

For commercial uses such as image processing, financial analysis, computer aided design and geophysical analysis.

And for such industrial tasks as vibration analysis and power transient monitoring and well logging.

Yet the price is only \$4250. (Quantity discounts available.)

If numbers have your micro in a crunch, call us. We'll show you how to make short work of long problems.

### Specifications:

**Program memory** 2K X 48 bit word

**Data memory** expandable 8K X 24

bit word **Data word** 24 bits long, 8-bit exponent, 16-bit mantissa **Maximum**

**Power Required** 15 watts **Standard**

**Routines** fast fourier transform, power spectral density, inverse FFT, auto correlation and FIR digital filter

Trademark: Multibus, Intel

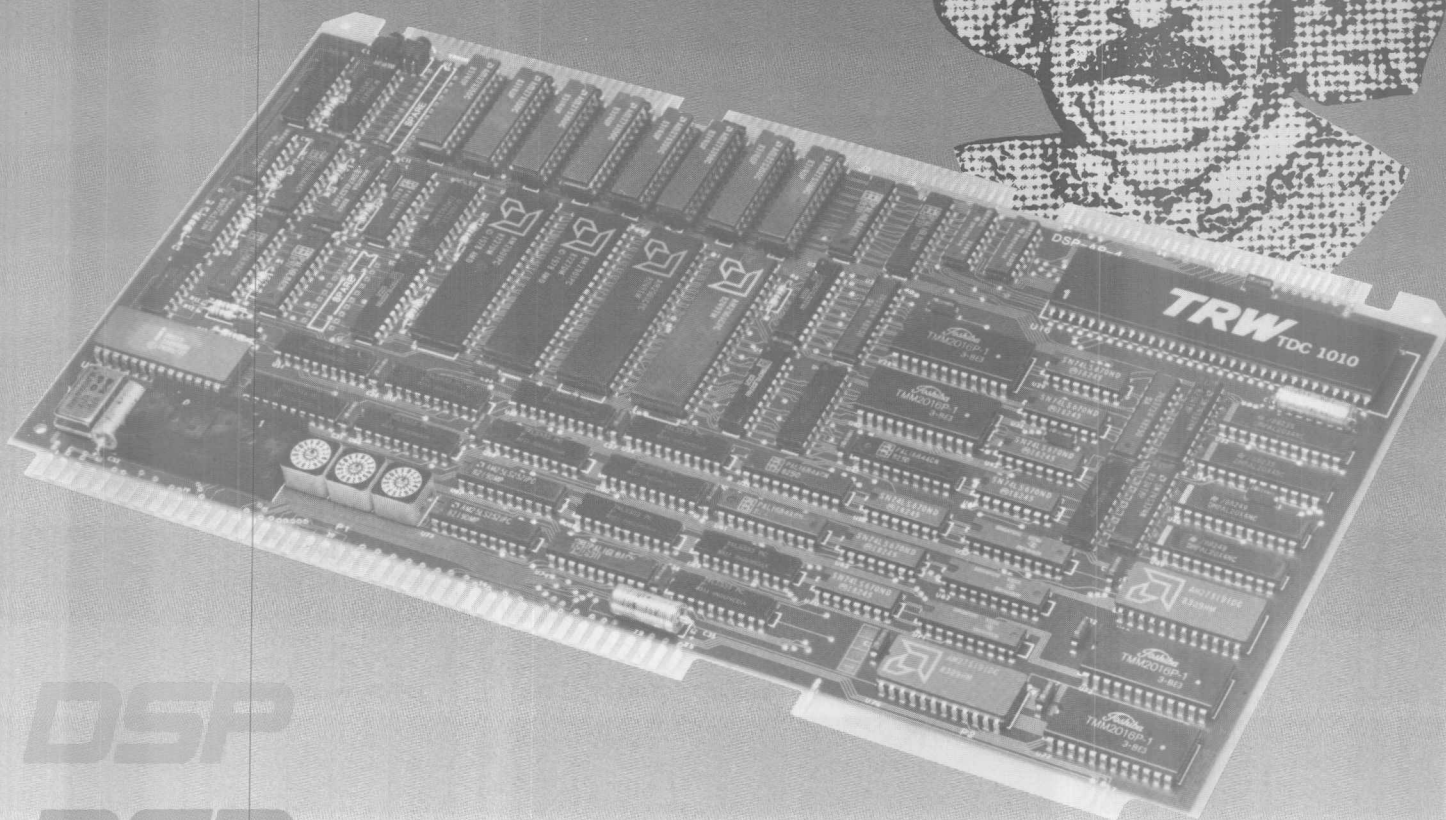
**MARINCO, INC.**  
A HELIONETICS COMPANY



11760 Sorrento Valley Rd.  
San Diego, CA 92121  
619/453-5203 Telex: 69-7901



# CUT 90% OUT OF DIGITAL SIGNAL PROCESSING COSTS WITH THE AP-4



DSP  
DSP  
DSP  
DSP  
DSP  
DSP

## "DSP...as easy as $\pi$ "

The AP-4 single-board, mini-Array processor performs the sophisticated signal processing you need for digital filters, complex FFTs, correlation and convolution. And, the AP-4 is easy to use because very little coding is required. Plus, the AP-4 offers the lowest cost per function per unit time, compared to other available array processors.

### FEATURES:

- UP TO 12 x 10<sup>6</sup> OPERATIONS/SEC
- 8.5 MSEC FOR 1024-POINT FFT
- 50 KHZ REAL TIME PROCESSING BANDWIDTH
- MULTIBUS™-COMPATIBLE (16 BITS)
- 14 HIGH-LEVEL INSTRUCTIONS
- "FRIENDLY", INTELLIGENT PERIPHERAL

**DSP SYSTEMS CORPORATION**  
1081 NORTH SHEPARD ST., M/S-E • ANAHEIM, CA 92806  
PHONE: (714) 630-1330 • TELEX: 298615 DSPS UR

## Other Functions

Manufacturer	Model	Price	DFA	Deliv.	Type
AMD ..... (408) 988-7777	94/2000	\$ 495	*8/83	stk	SBX Motherboard
AIM Technology ..... (408) 727-3711	BAB	\$1995	11/82	30da	Multibus Signal Analyzer
Alligator Computer Prod. .... (617) 662-0780	JEC-2764	\$ 17	*9/83	stk- 3wk	EEPROM Programmer
AMTEL CO .....	210A080	\$ 245 \$ 530*	3/82	stk	clock/calendar
Bit 3 Computer Corporation .....	401	\$ 995	11/82	stk	IBM PC to Multibus Interface
Dawn Technology, Inc. .... (408) 980-1122	831	\$25000	*9/83	stk	Multibus Backplane Test System
Digital Pathways, Inc. ....	TCU-410	\$ 360	-	-	Timing Control Unit
Distributed Computer .....	DCS/SERVO	\$2500	*12/83	stk	Positioning Servo
DSP Systems Corporation .....	DSP-FFT-1	\$3500	6/82	stk	Array Processor
	DSP-AP-4	\$3800	3/83	-	Array Processor
EG&G Reticon .....	RSB6020	\$ 895	-	-	Image Sensing Interface
ETI Micro .....	8150	\$ 660	3/82	stk	EPROM Programmer
Hal-Versa Engineering .....	Synergist	\$ 579	1/82	stk	Multibus-VERSAbus Adapter
	HBMB-	\$-	6/83	-	Multibus Repeater
	-	\$-	*10/83	-	Multibus to VMEbus
	-	\$-	*10/83	-	Multibus to VERSAbus

## Other Functions

### Distinguishing Features

Multibus board with 6 8/16-bit SBX connectors and interrupt controllers.

On-bus signal analyzer with cycle buffering 1024-4096 cycles. Built-in bus termination, user selectable. Power failure detect indicator.

28-pin JEDEC Device Includes software for Intel Series 3.

Simple interface to the PRIAM SMART Series of Winchester disk controllers, 4RS-232 Serial Channels, and MCL46818 time-of-day clock.

Multibus adapter makes the IBM PC I/O compatible with the IEEE 796.

Turn-key system. Finds shorts and defective termination. Includes Z80 based system, printer, test modules. Software and user manuals.

Rechargeable battery, provides second, min., hr., day, month, year.

Interface to DC servo driven positioning axis with incremental encoder feedback.

Fast Fourier transform, single card, up to 6 million multiplications and additions per second, FFTs from 16 to 1024 points, on-board DMA control, also supports double precision arithmetic. Requires 16-bit Multibus processor.

12 million operations per second, on-board DMA, 24-bit address.

Multibus interface for Reticon imaging cameras.

Occupies one slot; programs 2716, 2732, 2732A, 2764 EPROMS, 8 detachable ZIF sockets, use Friendly Software support available on diskette for either CPM or ISSIS; 8 or 16-bit words.

Conforms to VERSAbus spec. M68KVBS(D4) and Multibus spec. Rev.-03, 4/81; master, slave master/slave operation; buffered address and data buses.

Asynchronous bi-directional Multibus repeater - Supports 24-bit addressing - 30ns delay time, power on/off detection, with or without bus switching.

Distributed processing Bi-directional bus mastership. User selectable VMEbus priority. Supports 20 or 24-bit Multibus addressing. Worst case 200ns through-put delay down and back. Conforms to VMEbus spec. M68KVMETB(D2).

Conforms to a VERSAbus spec. M68KVBS(D4) and Multibus spec. Rev. 03, 4/81. Slave, master. Master/Slave operation. Buffered Address and data busses with 48mA drive. Supports all 7 priority levels & VERSAbus and Multibus vectored interrupts.

continued next page

## Other Functions

Manufacturer	Model	Price	DFA	Deliv.	Type
Ikon Corporation ..... (206)624-3410	10077	\$2150	6/82	stk	DEC DR11-W Emulator
	10077-NSC	\$2150	11/82	stk	Hyperchannel Adapter Interface
Intel Corporation ..... See Sales Office Listing	iSBC 310A	\$1100	-	-	Math Processing
LeCroy Research ..... 1506		\$ 495	-	-	Display Board
	3500-25	\$3995	12/82	-	CAMAC-Multibus Microprogrammable Controller
Linear Systems, Ltd. .... (204)774-7991	LS7482	\$ 376	5/82	stk	Clock/Calendar
Marinco, Inc. .... (619)453-5203	APB-3024M	\$4250	3/83	stk	Array Processor
Measurement Systems & Controls ..... (714)633-2240	MMU-3200	\$1000	-	-	Memory Management Board
Medinova Corporation ..... (312)870-0855	MSBX-241	\$ 355	1/83	stk	Real-Time Clock/Calendar
Mesa Technology Corp. .... (301)948-4350	86/11	\$3995	6/83	stk	Multibus to Unibus Adapter
Micomp Development Corporation ..... MX-201		\$ 295	4/83	-	Clock/Calendar
Micro Designs, Inc. .... (404)493-6318	MCA	\$4000	12/81	stk	Nuclear Multichannel Analyzer
Micro/Sys ..... MCL460		\$ 395	9/78	15da	Clock/Calendar
Monolithic Systems Corp. .... (303)770-7400	MSC8901	\$ 528	-	-	Memory Manager
Morrow Computer ..... (615)366-1979	SB-1004	\$ 495	6/80	stk	Supervisory Board



## Distinguishing Features

Complete DEC DR11-W emulation, including Multibus/UNIVUS interprocessor links; 8/16/20/24-bit addressing; 2Mbyte/sec DMA (including arbitration between cycles) with 24-bit linear address; high bus efficiency; multi-network gateway. Contact factory for custom interfaces.

Interface to Network Systems Corp. Hyper-channel Adapter; 8/16/20/24-bit addressing; 2Mbyte/sec DMA transfer rate (including arbitration time between cycles) with 24-bit linear address; high bus efficiency. Contact factory for custom interfaces.

Arithmetic slave processor; floating point math 32-bit format; fixed point integer math in 16-32-bit formats. Reference: iSBC 337, iSBX 332, and iSBX 331, numeric processor and Multimodule boards.

Provides static and dynamic displays of program execution for debugging.

Intelligent CAMAC and Multibus controller for the LeCroy System 3500. 24-bit architecture allows programmable CAMAC operations with standard CAMAC modules and 3500-Series CAMAC modules. Optimized for CAMAC and Multibus control.

iSBX-Module, single wide, programmable alarms, 1 yr. calendar.

FFT, inverse FFT, power spectral density, autocorrelation; solves autocorrelation matrix (Toeplitz), digital filtering, (cross correlation). Optional RAM version, 24-bit floating point.

16/32-bit memory management board. Centronics parallel and real-time battery-backed clock.

Accurate time-of-day/calendar data w/o wait states, non-volatile registers select daylight savings option, 12/24 hr., BCD/binary data, alarm and periodic interrupt sources. Includes 50bytes of NVRAM.

SBX MULTIMODULE. Battery protected.

Single board that allows high speed DMA transfers between Multibus and Unibus or LSI-11 (Q-Bus) products. Compatible with DR11-W interface.

SBX MULTIMODULE, battery protected.

1024-channel Pulse-Height analyzer; 20-bit count, 1-channel; set of 2 Multibus boards 80/85 ISIS-II software drives and cable included.

Timekeeping board with month, day, hours, minutes and seconds ports.

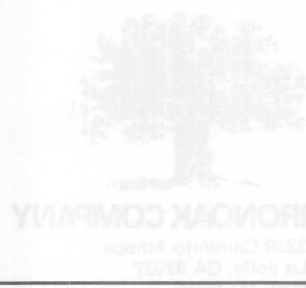
Battery powered time-of-day clock; programmable real-time interrupt; parallel bus master arbitration logic capable of controlling 8 bus masters; memory extender/page mapper logic extends addressing to 24-bit physical addressing. RAM disk emulation through I/O port with auto-incrementing address.

Automatically resets Multibus system after failure; alarm output for non-recoverable failures; real-time interrupt; 24 user-defined indicators/switches.

continued next page

## Other Functions

Manufacturer	Model	Price	DFA	Deliv.	Type
National Semiconductor ..... See Sales Office Listing	BLX-331	\$ 450	-	-	Fixed/Floating Point Math
Northern Precision Laboratories Inc. ... (201)227-4800	NPS-1000	\$ 575	3/83	4wk	SMPTE Time Code Translator
Procise Corporation ..... (206)392-0270	796 BUS REPEATER	\$ 795	2/83	4wk	Bus Repeater
Proteon Associates ..... (617)894-1980	PRO 80	\$1300	10/78	30da	Frequency Synthesizer
	PRO 88	\$1500	12/80	30da	Frequency Synthesizer
Silicon Control ..... (312)634-9313	MB1	\$ 349	★10/83	stk	Display Board
	MB2	\$1295	★11/83	stk	Display and Tracer Board
Sky Computers ..... 5100	SKYMNK-M	\$5990	3/82	30da	Array Processor
	5100	\$2600	-	-	Floating Point Processor
TITN, Inc. .... (415)348-9181 (612)831-4422	T/N/03 and 04	\$2850	81	6wk	Multiple Multibus Adapter
Zendex ..... (415)828-3000	ZX-906B	\$ 495	1/80	stk	Multibus Display Board
	ZX-907	\$2895	6/82	stk	Multibus Tracer Board
	ZX-908A	\$ 720	-	stk	EPROM Programmer
	ZX-914	\$ 895	3/83	stk	EPROM Programmer
	ZX-909	\$ 720	-	stk	EPROM Programmer



## Distinguishing Features

### Expansion Module.

8085 Microprocessor on-board. Inputs-200mu to 10upp audio time code. Balanced line - 24/30FPS select.  
Outputs - RS-422 - Frame sync. SMPTE data, TTL-Bypass errors.

Repeats Multibus signals into additional card cages. 24-bit address 16-bit data, 2 board set with cables.

Frequency range 10Hz to 2MHz; resolution 0.0023Hz; phase continuous, transient free switching, less than 40usec to update.

Frequency range 25Hz to 200MHz; resolution 10KHz to 1.25 MHz; includes SSB mixer to implement step and repeat synthesizers.

Display of 24-bit address, data, control, interrupts and bus exchange signals. Command selectable latching; 7 segment readout of address and data. Detachable display can be used remotely and panel mounted.

Display same as MB1. 2048-cycle trace buffer: stop and start trace on match condition or external trigger; CRT interface for optional control and display. Operates at maximum bus bandwidth

For Intel 8086 or Motorola 68000 based systems.

32-bit and 64-bit precision floating-point operations.

Multibus adaptations for connection between master rack and slave rack for orders, data and 18 IT.

Displays address, data and control signals; hardware single step stop; binary event match counter and display, bus voltage indicators.

Captures up to 1024 bus event cycles. The events may be displayed on a CRT as requested by break points.

Programs up to 16Kbytes of 2716, 2732 or 2732A at one time. Optional version with ZIF sockets mounted on separate PC board, programs up to 4Kbytes.

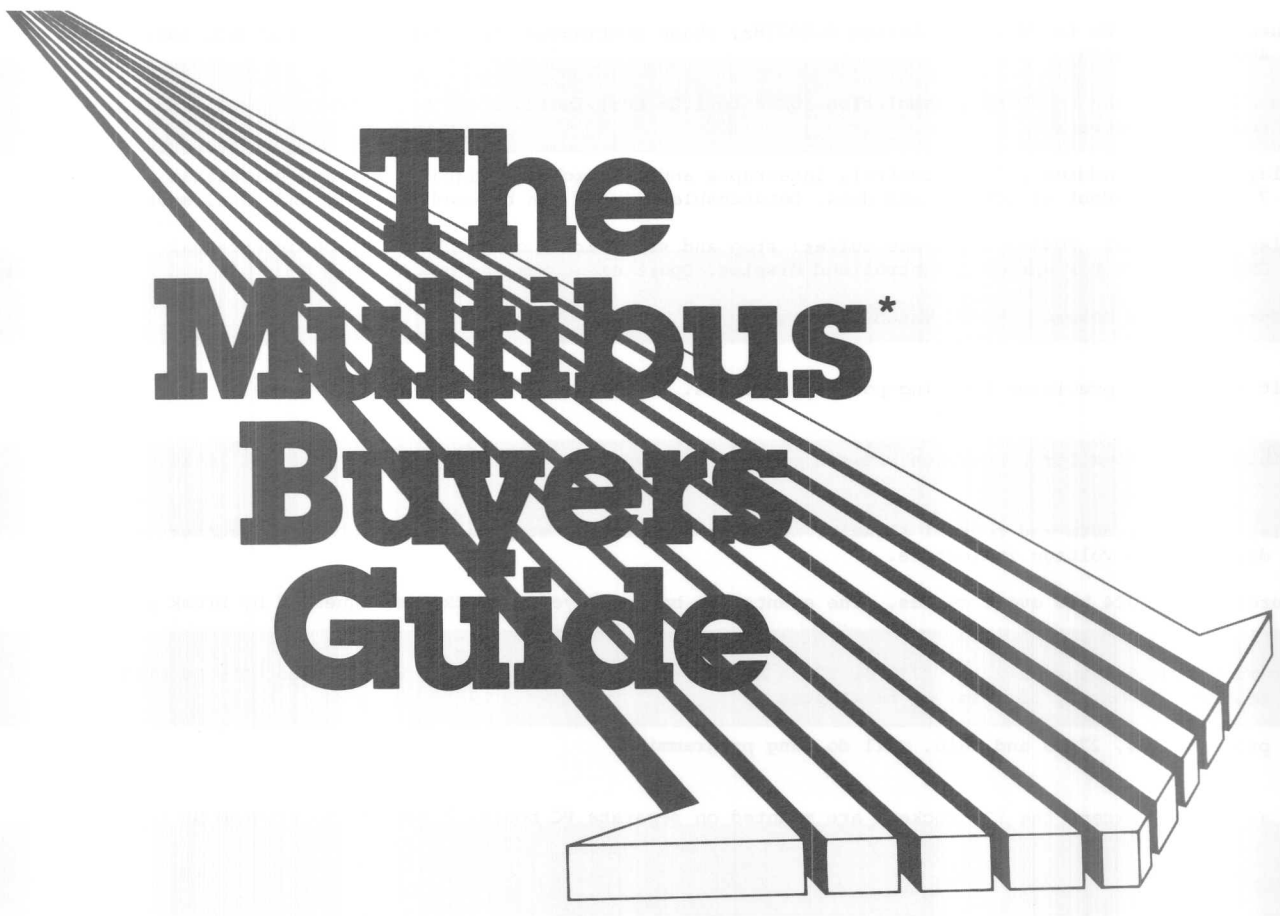
Will program 2764, 27128 and 2816. Will do gang programming.

Same as ZX-908A except the ZIF sockets are mounted on separate PC board. 2 sockets to program up to 4Kbytes.



**IRONOAK COMPANY**

3239 Caminito Ameca  
La Jolla, CA 92037  
(619) 450-0191



# **The Multibus<sup>\*</sup> Buyers Guide**

Ironoak publishes:  
The Multibus<sup>\*</sup> Buyers Guide  
The VMEbus Buyers Guide  
The STD BUS Buyers Guide  
The S-100 BUS Buyers Guide



# Intelligent Analog I/O

Data Translation, Inc.  
ETI Micro  
Heurikon Corporation  
Horus Computer  
Intel Corporation  
J & H Manufacturing  
Robotrol Corp.

# Intelligent Analog I/O

Manufacturer	Model	Price	DFA	Deliv.	Input Ch. S.E.	Diff.	CMRR (db)	CMV	PGA	Input Ranges (Volts FS)	Resolution (bits)
Data Translation ..... (617)481-3700	DT3752	\$1895	-	5da	16	8	76	±10	*	±10	12 14* 16*
	DT3772	\$ 595	-	5da	48	24	76	±11	-	-	-
	DT3754	\$1895	-	5da	16	8	80	±10	*	10mV to 10V	12 14* 16*
	DT3774	\$ 595	-	5da	48	24	80	±11	-	-	-
	DT3755	\$1895	-	5da	-	4	126	±250	*	10mV to 10V	12
	DT3775	\$ 695	-	5da	-	8	126	±250	-	-	-
	DT3762	\$1575	-	5da	-	-	-	-	-	-	-
ETI Micro ..... (415)829-6600	8131	\$ 900	1/82	stk	-	16	64	±10	o	+5,+10 4-20mA	12 dual slope
Heurikon Corporation ..... (608)271-8700	MLZ-DAQ	\$1895	-	-	32	16	-	-	o	±10	12
Horus Computer ..... 02202/84400	HCB702	\$1849	1/82	-	-	o	-	-	-	-	-
Intel Corporation ..... See Sales Office Listing	iSBC 88/40	\$2000	-	-	32	16	-	±10	o	±5	12
J & H Manufacturing ..... 21545	21545	\$-	-	-	8	-	-	-	-	-	-
Robotrol Corp. .... (408)778-0400	RMB 741	\$1210	2/82	stk	32	16	60	±20	o	±5,±10,±5,±10 0-20,50mA*	12

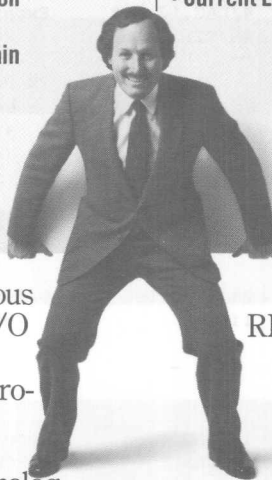
Conversion Time(usec)	Throughput Rate (KHz)	Micro- processor	I/O Serial RS232C	Conv. DC/DC	Output Channels/Type	Distinguishing Features
28.5	35 125*	8085A	1 20mA*	o	-	16K dual-port RAM; 16K EPROM capacity; DMA capability; 2 programmable real-time clocks.
-	-	N/A	-	o	0, 4 or 8/DAC V or 4-20mA	DT3752 expander, system capacity 64 S.E. or 32 Diff.
32 10V range	35	8085A	1 20mA	o	-	Same as DT3752 except low level, wide range inputs.
-	-	N/A	-	o	0, 4 or 8/DAC V or 4-20mA	DT3754 expander, system capacity 64 S.E. or 32 Diff.
-	20/sec	8085A	1	o	-	Same as DT3752 except isolated low level, wide range.
-	-	N/A	-	o	0, 4 or 8/DAC V or 4-20mA	DT3755 expander, 8 differential (up to 60 channels total with DT3755 and 7 units of DT3775).
-	-	N/A	1 20mA	o	4/DAC, 12-bit 48/TTL prog.	Expands functional capability of DT3752-54-55; 5 16-bit counter timers; 2 ROM/EPROM sockets. Optional floating point math.
70msec	14/sec	8085A	-	o	-	2K dual-port RAM; inputs protected to 120V; resident firmware, transient protected; +5V only.
-	-	Z80A	4	-	-	
-	-	8085A 8088*	1	-	12/	Mappable within 1MB of address space. Operation to 5MHz.
50	18	8088	iSBX351 or 352	-	24/parallel lines	9 level interrupt, 3 SBX connectors; optional 8087.
-	-	-	-	-	-	
25	23	8048	-	o	12/DAC v or 4-20mA	Memory mapped with 20-bit address. Consult factory for other I/O ranges.

# “When it comes to MULTIBUS™ Analog I/O, who else could hold up a chart this big?”

Fred Molinari, President

## MULTIBUS COMPATIBLE BOARDS & SOFTWARE

	LOW COST (12 to 16-Bit Resolution)	INTEL RMX-80™ AND RMX-86™ COMPATIBLE (12-Bit Resolution)	INTELLIGENT ANALOG PERIPHERALS (12 to 16-Bit Resolution 8085 CPU, 16KB Dual Port RAM)
ANALOG INPUT (16 to 64 Channels)	DT1742 High Level DT1744 Low Level DT1748 Isolated Low Level	DT711 32-Channel	DT3752 High Level DT3754 Low Level DT3755 Isolated Low Level
ANALOG OUTPUT (12-Bit)	DT1841 2-Channel Point Plotter DT1842 8-Channel DT1843 8-Channel (8-Bit)	DT724 4-Channel  DT728 8-Channel	DT3776 8-Channel Expander DT3762 Multifunction Expander
ANALOG I/O 16 Inputs 2 Outputs	DT1751 High Level DT1755 Low Level DT1759 Isolated Low Level	DT732 32 inputs/ 2 outputs	
OTHER FEATURES	<ul style="list-style-type: none"> <li>• Analog Expansion</li> <li>• Current Loop Option</li> <li>• Up to 125kHz A/D</li> <li>• Programmable Gain</li> </ul>	<ul style="list-style-type: none"> <li>• Programmable Gain</li> <li>• Current Loop Option</li> </ul>	<ul style="list-style-type: none"> <li>• DTFIRM Measurement &amp; Control Firmware</li> <li>• Digital I/O</li> <li>• Current Loop Option</li> <li>• Up to 100kHz A/D</li> <li>• Monitor ROM</li> <li>• Programmable Gain</li> <li>• On-Board Serial I/O</li> <li>• Analog Expansion</li> </ul>



As you can see, we have an enormous line of MULTIBUS compatible analog I/O systems.

High-level, low-level, isolated, and programmable gain. Up to 64 A/D channels on a single board.

Our line includes the Intelligent Analog Peripheral, the most powerful and flexible analog I/O product available on MULTIBUS.

The one-of-a-kind IAP was our invention. You'll find that each of our boards is unique in its ability to solve real world problems.

Take flexibility. Thanks to their modular design, our boards can be enhanced for higher speeds and resolution simply by plugging in a Datax II module.

Many of our boards are compatible with RMX-80 software. All are designed to work with our new line of signal conditioning products.

Further, we offer firmware for data acquisition software development.

DTFIRM for general purpose data acquisition. And DTTHERM for thermocouple linearization.

Most important perhaps, we will deliver any board within *five* days.

We hold up a big chart, but we'll never hold *you* up.



For a copy of our 336 page catalog call Data Translation. Or turn to Volume III of the Gold Book.

# DATA TRANSLATION

World Headquarters: Data Translation, Inc., 100 Locke Dr., Marlboro, MA 01752 (617) 481-3700 Tlx 951-646.  
European Headquarters: Data Translation, Ltd., 430 Bath Rd., Slough, Berkshire SL1 6BB England (06286) 3412 Tlx 849-862.  
MULTIBUS, INTEL RMX-80 and RMX-86 are trademarks of Intel Corporation.



# Analog I/O Combination

ADAC Corp.  
 Analog Devices  
 Burr-Brown  
 Data Translation, Inc.  
 Datal  
 Diversified Technology, Inc.  
 EMM/Sesco  
 Robotrol Corporation  
 Zendex Corporation

# Analog I/O Combination

Manufacturer	Model	Price	DFA	Deliv.	Input Diff.	Ch. S.E.	Input Ranges (Volts FS)	Resolution (12 bits)	PGA	CMRR (db)	CMV
ADAC .....	735 A/D/A	\$ 620	-	-	8 32*	16 64*	±10 0-20,50mA*	o	*	-	±5
Analog Devices ..... (617) 329-4700	RTI-732	\$ 745	6/82	stk/ 2wk	16	32	±5,±10,±5,±10 4-20mA	12	1,2,4,8	60	±10.24
Burr-Brown ..... (602) 747-0711	MP8418-AO	\$ 795	-	-	15 63*	31 127*	±10	o	*	74	±26
	MP8608-AO	\$ 625	-	-	8 32*	16* 64*	±5	8	-	66	±15
Data Translation ..... (617) 481-3700	DT1751	\$ 795	-	5da	8 32*	16 64*	±10 4-20mA*	o 14*16*	*	-	-
	DT1755	\$ 895	-	5da	8	16	±10	o 14*16*	*	-	-
	DT1759	\$1175	-	5da	4 60*	-	±10	o	*	166	±250
	DT732	\$ 795	-	5da	16	32	±10 4-20mA*	o	*	-	-
Datel ..... (617) 339-9341	ST-732	\$ 788	-	-	16	32	±10	o	o	100	±12
DI-AN Microsystems ..... (061) 442-9768	DMS531	-	-	-	8	16 64*	±5mV to ±10V	o 16*	o	-	-
Diversified Technology .... (601) 856-4121	CBC 8731-2	\$1340	6/82	stk	8 16*	16 32*	±10	o	o	80	±10
EMM/Sesco ..... 732	SECS-80/	\$4700	-	-	-	-	-	-	-	-	-
Robotrol Corporation ..... (408) 778-0400	RMB-730	\$1050	81	2wk	8 16*	16 32*	±5,±10,±5,±10 0-20,50mA*	o	o	60	±20
Zendex Corporation ..... (415) 828-3000	ZBX-324	\$ 291	-	stk	-	o	±10	8	-	-	-



board. I/O modules allow you to mix and match sensor or analog inputs—including thermocouple, RTD, strain gage, mV, and  $\pm 50\text{mA}$  process loops—and convert them into high level 0 to  $\pm 10\text{V}$  output. Features include 230V rms input protection,  $\pm 1500\text{V}$  isolation, filtering, low drift amplifiers, and sensor excitation.

From analog signal conditioning to board-level data acquisition and control, no one comes close.

Conversion Throughput		DC/DC	Ch.	Resol.	Output Range	Distinguishing Features
Time (usec)	Rate (KHz)					
-	35	*	1	12	$\pm 10$ 4-20mA*	Choice of program control or program interrupt; compatible with SBC 80/10, 80/20; MDS-800
25	2	*	2	12	$\pm 10$ 4-20mA*	Direct plug-in replacements with industry standard 711/724/732 analog I/O boards. Memory-mapped 20, 22, or 24-bit addressing, single +5V operation.
-	38	o	2	12	$\pm 10$	Software PGA; expandable to 127 SE channels with MP8418-EXP or 63 different channels with isolated MP8418-ISDE; thermocouple inputs available.
44	-	o	2	8	$\pm 10$	
-	35 100*	o	2	12	$\pm 10$ 4-20mA*	Point plotting
-	35 100*	o	2	12	$\pm 10$ 4-20mA*	Low level board, point plotting.
-	-	o	2	12	$\pm 10$ 4-20mA*	Point plotting, integrating A/D, flying capacitor switching; isolated; thermocouple input terminal available.
-	24	o	2	12	$\pm 10$ 4-20mA*	Compatible with SBC 732; pacer clock.
23	20	o	2	12	$\pm 10$ 4-20mA*	
-	-	*	4	13 16*		Optional 8-bit optically isolated input and outputs.
24msec	41Hz	*	2 1*	12	$\pm 10$ 4-20mA*	CMOS technology for low power operation; 1.8W of power dissipation. 11 Range PGA, RMS to DC converter option. Industrial version available.
-	-	-	-	-	-	MIL-Spec. version of iSBC 732.
25	23	o	12	12	$\pm 10$ 4-20mA*	Memory-mapped with 20-bit address. Consult factory for other I/O ranges.
18	-	-	2	8	10 or 2.6V	SBX Module; compatible with SBC 80/10B and 80/24; 15V not required.

**From analog signal conditioning to board-level data acquisition and control, no one comes close.**

Whatever your signal conditioning or analog I/O needs, we've got the best way to go. As a recognized leader in data acquisition, we can get your analog signals to the MULTIBUS™ with the broadest range of solutions in the industry.

Our 3B Series signal conditioning subsystem provides an easy and convenient solution to signal conditioning problems associated with connecting sensors to an analog

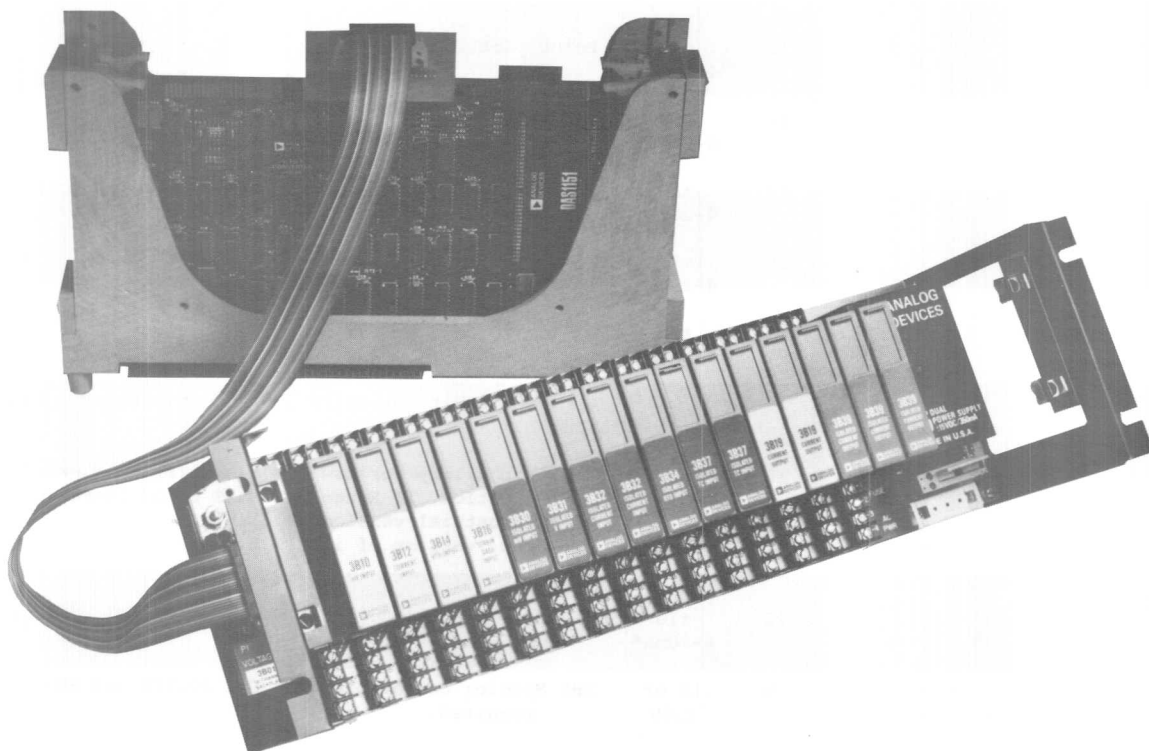
board. I/O modules allow you to mix and match sensor or analog inputs—including thermocouple, RTD, strain gage, mV and 4-20mA process loops and converts them into high level 0 to +10V outputs. Features include 220V rms input protection,  $\pm 1500V$  isolation, filtering, low drift amplification and sensor excitation.

Our RTI-711 Series (Real Time Interface) boards are cost effective analog input, output and combination I/O boards compatible with the MULTIBUS™. They feature 12-bit resolution, programmable gain, analog channel expansion capability, 4-20mA output and on-board dc/dc converters.



They interface to the MULTIBUS™ in the memory mapped mode over the entire 24-bit address range.

Whether your application requires sensor signal conditioning, analog I/O boards, or both, Analog Devices is the best way to go. And we'll get you there with technical assistance, user manuals, and application support unmatched in the industry. For complete information on these products, call or write today.



**If we can't get your  
analog signals into the  
MULTIBUS™, no one can.**

MULTIBUS is a Trademark of Intel Corporation

Analog Devices, Inc., Two Technology Way, Norwood, MA 02062; Headquarters: (617) 329-4700; California: (714) 842-1717, (408) 947-0633; Colorado: (303) 320-6076; Illinois: (312) 653-5000; Maryland: (301) 992-1994; Michigan: (313) 694-5450; New Jersey: (201) 967-1126; Ohio: (614) 764-8870, (216) 562-3115; Oklahoma: (216) 562-3115; Pennsylvania: (215) 643-7790; Texas: (713) 664-5866; Belgium: (32 3) 237 48 03; Denmark: (45 2) 845800; France: (33 1) 687-34-11; Holland: (31 1620) 51080; Israel: (972 52) 28995; Italy: (39 2) 6898045; (39 2) 6894924; Japan: (81 3) 263-6826; Sweden: (46 8) 282740; Switzerland: (41 22) 31 57 60; United Kingdom: (44 1) 9410466; West Germany: (49 89) 570050.



# Analog Input

ADAC, Inc.  
Analog Devices  
Burr-Brown  
Data Translation, Inc.  
Datel  
Diversified Technology  
Intel Corporation  
Megalogic Corporation  
National Semiconductor Corp.  
Northern Precision Laboratories, Inc.  
Robotrol Corp.

# Analog Input

Manufacturer	Model	Price	DFA	Deliv.	Input Ch.		Input Voltage Ranges (V)				Resolution (12 bits)	PGA
					Diff.	S.E.	+5	±5	+10	±10		
ADAC .....	735 A/D	\$ 495	-	-	8 32*	16 64*	o	o	o	o	o	*
	710	\$ 845	-	-	8	-	10 to 500mV FS				o	o
Analog Devices ..... (617) 329-4700	RTI-711	\$ 645	6/82	stk/ 2wk	16	32	0-5V, 0-10V, ±5V, ±10V				12	1,2,4,8
Burr-Brown ..... (602) 747-0711	MP8409-NS	\$ 585	-	-	8	- 16*	±10mV to ±10V				o	o
	MP8608	\$ 470	-	-	8	- 16*	±10mV to ±5V				8 12*	-
	MP8418	\$ 595	-	-	15 48*	31 96*	±10mV to ±10V				o	*
	MP8418- 150E	\$ 695	-	-	16 63*	-	±10mV to ±10V				-	-
	MP8632	\$ 590	-	-	32	64	±10mV to ±5V				8	-
	MP8430	\$ 750	-	-	16	-	RTD inputs (3-wire)				o	-
Data Translation ..... (617) 481-3700	DT0711	\$ 645	-	5da	16	32	o	o	o	o	o	o
	DT1748	\$ 775 \$1175*	-	5da	-	12	±10mV				o	*
	DT1742	\$ 495	-	5da	8 32*	16 64*	o	o	o	o	o	-
	DT1744	\$ 595	-	5da	8	16	10mV to 10V				o	*
	DT712	\$ 795	1/83	5da	8 64*	16 128*	-	-	o	o	o	1,2,4,8
	DT772	\$ 795	1/83	5da	8 32*	16 64*	±10mV to ±10V				o	1,2,4,8
	DT778	\$1195	1/83	5da	-	4 12*	0 to +10, ±10V				12	o

Input Analog

CMRR (db)	Conversion CMV	Conversion Time(μsec)	Throughput Rate (KHz)	Data Bus/ Address (bits)	DC/DC	Distinguishing Features
70	±5	-	35	*	-	Input voltage protection up to ±40V. Voltage/current loop inputs.
-	±250	5msec	-	*	-	Expandable to 128 channels; flying capacitor switching; direct thermocouple measurement.
60	±10.24	25	40	o	-	Memory-mapped I/O, 20, 22, or 24-bit addressing; single +5V operation. 4-20mA Input.
-	-	33	-	*	-	
-	-	44	-	o	-	
-	-	38	-	o	-	Memory-mapped; optional software programmable gain (1-1024); connector kits and cable assemblies available.
-	-	-	18msec	o	-	Flying capacitor isolation; 400V channel to channel isolation; compatible with Inteltec MDS and iSBC.
-	-	44	-	o	-	
-	-	25	-	-	-	RTD input board; includes RTD signal conditioning and line length compensation; 100 or 1000 ohm.
-	-	-	24	o	-	Plug compatible with SBC 711.
-	-	-	-	o	-	
-	-	30	35	o	-	
-	-	40	-	o	-	
80	±11	-	25	o	8-16/20	Memory or I/O mapping, 512SE/256 Diff. max. input 2 board set, option DT714 for low level inputs.
80	±11	-	25	o	8,12,16 20,24	Memory or I/O mapped (jumper selectable); left hand justified (12 and 14-bit versions).
-	-	4	100	o	8-16	Memory or I/O mapped (jumper selectable).

continued next page

# Analog Input

Manufacturer	Model	Price	DFA	Deliv.	Input Ch.		Input Voltage Ranges (V)				Resolution (12 bits)	PGA
					Diff.	S.E.	+5	±5	+10	±10		
Datel ..... (617)339-9341	ST-711	\$ 624	-	-	16	32	o	o	o	o	o	o
	ST-800-16S	\$ 720	-	-	8* 16*	16 32*	o	o	o	o	o	-
	ST-711 RLY	\$ 968	-	-	8 16*	-	10mV to 2V				o	-
Diversified Technology ... (601)856-4121	CBC 8732-0	\$ 980	6/82	stk	8* 16	16* 32	±10mV to ±10V				o	o
Intel Corporation ..... See Sales Office Listing	iSBX 311	\$ 610	-	-	8 16*	16 32*	o	o	-	-	o	o
Megalogic .....	GAB-1/MN	\$ 395	-	2wk	-	4	0 to ±4.095V				o	-
National Semiconductor ... See Sales Office Listing	BLC-8737-1	\$ 729	-	stk	16 32*	8 16*	o	o	o	o	o	o
Northern Precision Labs .. (201)227-4800	NPI-1400	\$2700	82	4wk	1	6	o	-	-	-	14	-
Robotrol Corp. .... (408)778-0400	RMB-720	\$ 645	81	2wk	8 16*	16 32*	o	o	o	o	o	o



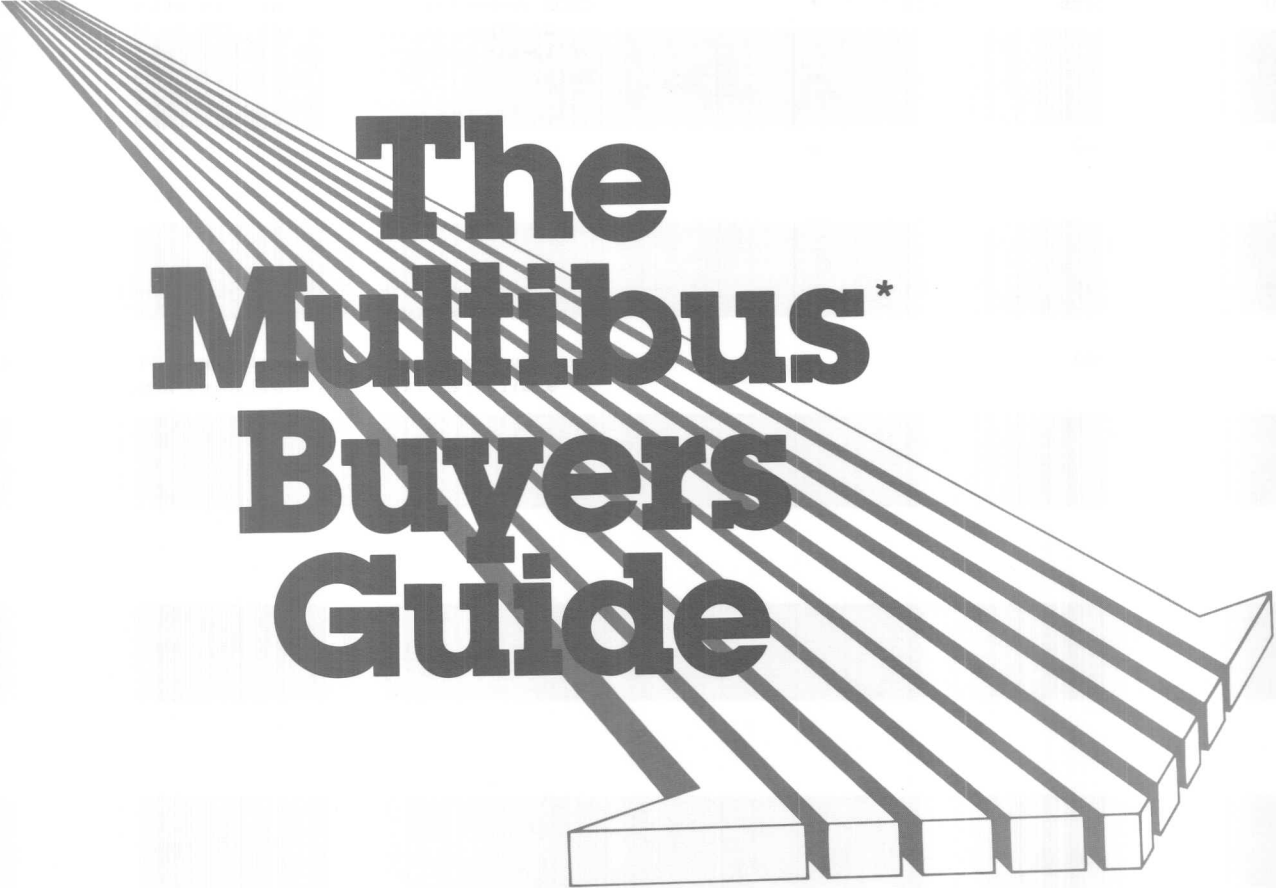


CMRR (db)	CMV	Conversion Time(usec)	Throughput Rate (KHz)	DC/DC	Data Bus/ Address (bits)	Distinguishing Features
80	±35	20	23	o		+5Volts only.
-	±35	20	23	o		+5Volts only; DMA.
126	±250	-	30/sec	N/A		Includes 10-stage pacer clock; external scan start; flying capacitor relay multiplexer.
80	±10.24	24ms	41Hz	*		CMOS technology for low power operation; 1.1W of power dissipation. 11 Range PGA. RMS to DC converter option. 12-bit integrating ADC. Industrial version available. Multimodule, 20mV to 5V full scale input ranges.
-	±30	50	18	o		
-	-	20	23	o		
60	-	-	-	-		
60	±20	25	23	o		Memory-mapped with 20-bit address. Consult factory for more sensitive input ranges.
-	-	280	-	-		Input voltages of +5, ±15, ±12 and +24. 2-card set. 8 differential lines available. Expandable.



**IRONOAK COMPANY**

3239 Caminito Ameca  
La Jolla, CA 92037  
(619) 450-0191



# **The Multibus<sup>\*</sup> Buyers Guide**

Ironoak publishes:  
The Multibus<sup>\*</sup> Buyers Guide  
The VMEbus Buyers Guide  
The STD BUS Buyers Guide  
The S-100 BUS Buyers Guide

# Analog Output

ADAC Corp.  
Analog Devices  
Anitech Systems, Inc.  
Burr-Brown  
Data TRanslation, Inc.  
Datel  
EMM/Sesco  
ETI Micro  
Intel Corporation  
Northern Precision Laboratories, Inc.  
Robotrol Corp.

# Analog Output

Manufacturer	Model	Price	DFA	Deliv.	No. of Channels	Output ±2.5	Output +5	Output ±5	Output +10	Output ±10	Current 4-20mA	Resolution (12 bits)
ADAC .....	735 DAC	\$ 310	-	-	1 (2,3,4)*	o	o	o	o	o	*	o
Analog Devices ..... (617)329-4700	RTI-724	\$ 495	6/82	stk/ 2wk	4	-	o	o	o	o	*	o
	RTI-724-V	\$ 495	6/82	stk	4	-	o	-	o	o	-	o
Anitech Systems Inc....	1002	\$ 750	1/82	2wk	16	-	-	-	o	-	-	8
Burr-Brown ..... (602)747-0711	MP 8305-NS	\$ 550	-	-	4	-	-	-	-	o	-	o
	MP 8316-I	\$ 650	-	-	16				N/A		o	o
	MP 8316-V	\$ 550	-	-	16	o	o	o	o	o	N/A	o
Data Translation ..... (617)481-3700	DT0724	\$ 595	-	5da	4	-	o	o	o	o	o	o
	DT1841	\$ 495	-	5da	2	-	o	o	o	o	-	o
	DT1842	\$ 995	-	5da	8	-	-	-	o	o	o	o
	DT1843	\$ 745	-	5da	8	-	-	-	o	o	o	8
	DT728	\$ 745		5da	4 8*	-	o	-	o	-	*	o



tuqtuO goloA

Conversion Time (usec)	DC/DC	+5V Only	Data Bus/ Address (bits)	Distinguishing Features
-	*	-	-	Memory or I/O mapped. 4-20mA current loop outputs.
5	o	o	o	Memory-mapped, I/O, 20, 22 or 24-bit addressing, on-board DC/DC.
-	o	o	o	Same as RTI-724 except voltage output only.
-	-	-	-	Memory or I/O mapped.
10	*	*	*	Individual DACs; connector kits and cable assemblies available.
3.5	o	o	o	Single D/A drives 16 outputs; data for each channel stored in RAM and selected without host intervention; memory or I/O mapped; 20-bit address.
3.5	o	o	o	Same as MP 8316-I except voltage outputs.
4	o	o	o	Direct replacement for SBC 724.
3	o	o	o	
3	o	o	o	
1	o	o	o	
2.5	o	o	8-16/20	

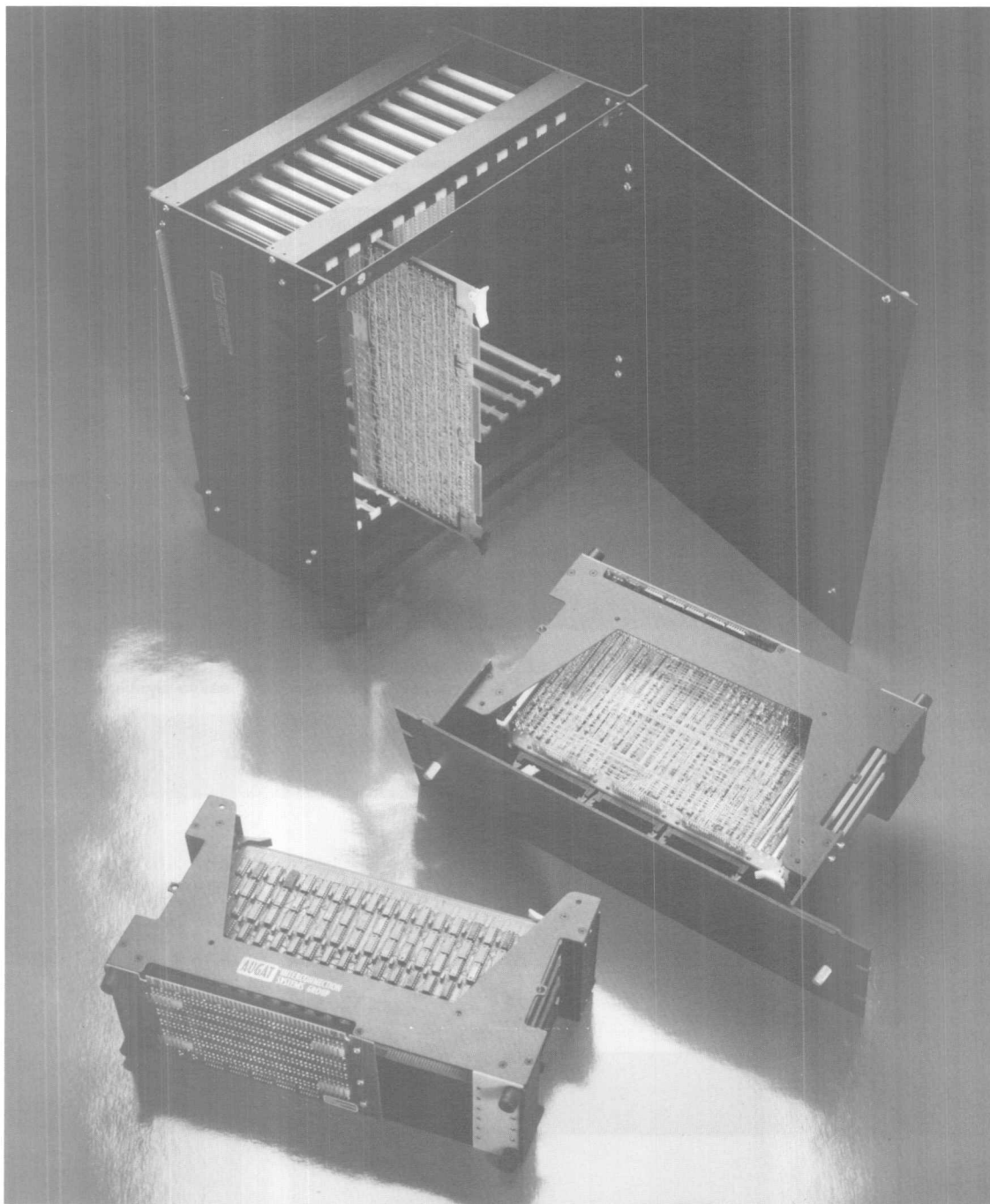
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# Analog Output

Manufacturer	Model	Price	DFA	Deliv.	No. of Channels	Output ±2.5	±5	±5	±10	±10	Current 4-20mA	Resolution (12 bits)
Datel ..... (617) 339-9341	ST-800-16D	\$ 775	-	-	16	o	o	o	o	o	-	o
	ST-724	\$ 575	-	-	4	-	o	o	o	o	o	o
	ST-716A1	\$ 690	9/82	-	4 8*	-	-	o	o	o	-	16
	ST-728A	\$ 545	-	-	4	-	o	o	o	o	o	o
EMM/Sesco .....	SECS 80/724	\$4450	-	-	4	-	o	o	o	o	o	o
ETI Micro ..... (415) 829-6600	8135	\$1480	1/82	stk	8	-	o	-	o	-	o	o
Intel Corporation .... See Sales Office Listing	ISEX 328	\$ 750	-	-	8	o	o	o	-	-	o	o
Robotrol Corp. .... (408) 732-8813	RMB-710	\$ 745	81	stk	12	o	o	o	o	o	o	o
Northern Precision ... (201) 227-4800	NPC 1300	\$ 750	82	4wk	6	-	-	-	-	-	-	13

Conversion Time (usec)	DC/DC	+5V Only	Data Bus/ Address (bits)	Distinguishing Features
4	*	o		Expandable channel increments to 256 channels; DMA capability; scan by: programming, on-board timer, external pulse.
4	o	o		Direct replacement for SBC 711/732.
o	*	*		8-16-bit CPUs 20-bit addressing; memory-mapped; accurate to 0.005% of FS reading.
5	*	o		Compatible with 8 and 16-bit CPUs; optional 8 D/A channels/board; overall accuracy $\pm 0.05\%$ FS.
-	-	-		MIL-Spec. version of BLC-724.
-	o	o		Both voltage and current output provided for each channel; meets IEEE 472-1974 surge withstand.
20	o	-		Multimodule, intelligent interface with programmable offsets.
-	o	-		Voltage or current loop selectable version available. Memory-mapped with 20-bit address. Consult factory for other output ranges.
-	-	-		Voltage range of $\pm 10.24$ (each channel adjustable). Designed for multi-axis robotic controller in closed loop servo systems.

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# Prototyping Boards

Artec Electronics  
Augat Interconnection Systems  
Central Data Corporation  
Chen Digital Laboratories  
Comark Corporation  
Douglas Electronics, Inc.  
EECO Incorporated  
Electronic Solutions  
ETI Micro  
Garry Electronics  
General Digital Corp.  
Hybricon Corp.  
Intel Corporation  
Logitech, Inc.  
Matrox Electronic Systems  
MDB Systems  
Mtacomp, Inc.  
Methode Electronics  
Monolithic Systems  
Mupac Corporation  
National Semiconductor Corp.  
Protek, Inc.  
Scanbe, Div. of Zero  
Schneider Instruments  
Vector Electronics  
Vero Electronics  
Zendex Corporation

# Prototyping Boards

Manufacturer	Model	Price	DFA	Deliv.	No. Columns	16-Pin DIP Capacity	Edge Connector (No./Pins)
Artec Electronics .....	Multi-Circuit	\$65	-	-	-	130	1/50,1/40,1/26
	Multi-Purpose	\$150	-	-	-	95	-
Augat ..... (617)222-2202	8136-UG159	\$402	75	stk	36	90	2/50,1/40 WW headers
	050-UG159	\$143	-	2wk	36	108	Any combination; flat cable headers 1/40,2/50
	813-HPG16	\$-	9/82	stk	44	132	1/40,2/50
Central Data ..... (217)359-8010	B1011	\$100	3/80	stk	-	95	2/50
Chen Digital Laboratories .....	D1003-X	\$75	3/82	stk	-	65	4 configurations
	DSGN-X	\$95	3/82	stk	-	78 14-pin	3 configurations
Comark Corporation ..... (617)359-8161	MB-WWC	\$150	-	-	13	-	4/50
Dawn Technology, Inc. .... (408)980-1122	Protoboard	\$98	3/83	stk	-	-	-
Douglas Electronics, Inc. .... (415)483-8770	32-DE-16	\$63	1/81	stk	19	95	
	32-DE-16-W	\$143	1/81	stk	19	95	
	12-DE-16	\$55	1/81	stk	-	-	
	12-DE-16-P	\$153	1/81	stk	-	-	
	12-DE-16-B	\$16	6/82	stk	-	-	
	12-DE-16-A	\$20	6/82	stk	-	-	
EECO Incorporated .....	-80-01	\$155	12/79	stk	-	132	2/50,1/26,1/86,1/60

# Prototyping Boards

## Distinguishing Features

Buffering and control logic for Multibus slave interface prototyping.

Buffering and control logic; 16-bit address; 16-bit data.

Standard universal WW packaging panel. Devices with between row spacing of .3", .6" or .9", may be plugged into the panel at any location, with decoupling capacitor sites next to each device.

Unilayer, universal packaging panel. Devices with between row spacing of .3", .6" or .9", may be plugged into the panel at any location, with decoupling capacitor sites next to each device.

Hi-Pak, universal packaging panel. Devices with between row spacing of .3", .6" or .9", may be plugged into the panel at any location, with decoupling capacitor sites next to each device.

Sockets with pin spacings of .3" and .6".

Includes P1 and P2 connectors. Layed out for 20-pin dual inline devices, .3", .6" and .9" centers.

Multibus compatible wire-wrap panel has 19 dual rows of 47 pads each, providing the equivalent capacity of 95 16-pin sockets. Plated-thru holes, gold finger tabs on FR-4 glass epoxy.

Same as 32-DE-16, but with 95 16-pin wire-wrap sockets installed. Pins extend .600" on the wiring side; sockets and pins on component side extend .300" above board surface.

Will hold up to 5 rows of IC's; each dual row contains 109 pads spaced on .100" intervals. .900" width of each row allows mounting of virtually any size IC as well as access to each pin. Vcc and GND fully distributed around board.

Same as 12-DE-16, but with .300" wire-wrap pins mounted in the outermost holes in each dual row of pads, as well as in the holes feeding the fingers. Boards designed to nest with adequate clearance on .500" motherboard centers.

Multimodule, compatible with iSBX system of on-board expansion for SBC boards. Mounting holes align with those on SBC host board. General purpose breadboarding areas as well as additional I/O pads at edge of board.

Multimodule, same as above except in larger size. Power and ground traces on each board run directly to the iSBX connector pins. (iSBX connector not included.)

Wire-wrap pins installed for all I/O fingers and for power distribution.

continued next page

# Prototyping Boards

Manufacturer	Model	Price	DFA	Deliv.	No. Columns	16-Pin DIP Capacity	Edge Connector (No./Pins)
Electronic Solutions ..... (619) 242-0292 (800) 854-7086	PR 80H	\$85	-	stk	-	90	2/25
	PR 80A	\$355	1/82	stk	-	38	3/25
ETI Micro ..... (415) 829-6600	8152	\$50	3/81	stk	-	114	dual row header
Garry .....	EP146	\$335	-	stk	-	-	-
General Digital ..... (203) 528-9041	GDX- PROTO-1	\$60	12/81	stk	-	-	72-pin I/O
Hybricon ..... (617) 486-3174	2-8010A-T	\$108	6/78	stk	62	138	2/50,1/40
	2-8010B-T	\$127	6/78	stk	62	138	edge conn. fingers
	4-8010A-VHF	\$348	9/80	2wk	62	138	2/50,1/40
	4-8010B-VHF	\$367	9/80	2wk	62	138	edge conn. fingers
	4-8010C-VHF	\$405	3/83	2wk	70	168	2/50,1/40
	4-8010D-VHF	\$962	★8/83	stk	70	336	2/50,1/40
Intel Corporation ..... See Sales Office Listing	iSBC 905	\$130	-	-	-	96	1/100
Logitech, Inc. .... (415) 326-3885	PY9000-XPB	\$99	7/82	-	-	144	2/50,1/25
Matrox Electronic ..... (514) 735-1182	PTB-1	\$115	-	-	-	120	-
MDB Systems .....	MNTL-GP-16	\$295	-	-	-	48	3/50
	MNTL-WWB	\$145	-	-	12	60	WW pins



## Distinguishing Features

Provision for mounting -5V regulator and decoupling +5V input; optional double height board \$185.

Interface/prototyping board; 20-bit address decoding, 8-16-bit data bus; interfaces to 8 peripheral devices; XACK & AACK; optional double height board \$455.

Room for 38 bypass capacitors for the +5V supply.

Several configurations available.

Prototyping expansion module; replaces National BLX-391; accepts 40+60 Pin ICs. 72-pin right angle I/O connector power and SIP areas, layout guide provided.

Plated through holes for installation of all DIP sizes, spacing on .3", .4", .5", .6" and .9" centers. Quantity of power voltages - five.

Has 62 columns with 52 holes per column. Vcc, Gnd and I/O pins installed. Reproducible documentation for ease in configuration control.

Exclusive VHF configuration is suitable for high speed analog, ECL, Schottky, T<sup>2</sup>L and general logic applications. 52 of 62 columns pinned with socket pins.

Provides lowest noise of all competitive configurations. Negligible series inductance in bypass path with individual device bypassing. Custom pinning process available, Socket-Sert<sup>R</sup>.

Highest density available on Multibus compatible wire-wrap board. Continuous ground plane acts like third layer. 70 of 70 columns pinned with socket pins.

Double height multilayer board custom pinned with Socket-Sert<sup>R</sup> or 4-format. 19" Rack Backplane/Card Frame Assembly provides long side plates, board handler extractor unique.

continued next page

# Prototyping Boards

Manufacturer	Model	Price	DFA	Deliv.	No. Columns	16-Pin DIP Capacity	Edge Connector (No./Pins)
Metacomp, Inc. .... (619)571-1168	MPA-1000	\$2395	9/82	30da	-	-	-
Methode Electronics .....	300-1000-XXX	\$530	-	-	45	108	1/86,1/60
	Series 2200	\$-	1/83	-	28	48	1/86,1/60
Monolithic Systems .....	MSC 8204-01	\$225	-	-	-	84	2/50,1/26
(303)770-7400							
Mupac Corporation .....	315 series	\$459	8/80	stk	54	150	triple row header
(617)588-6110							
National Semiconductor .....	BLC-905	\$105	-	stk	-	108	1/100
See Sales Office Listing							
	BLC-8905	\$99	-	stk	-	108	2/50,1/26
	BLX-391	\$100	-	stk	-	14	-
Prototek .....	WWA-126	\$125	3/79	stk	-	-	1/100
(513)874-5094							
	WWB-126	\$115	3/79	stk	-	-	dual row header
Scanbe, Div. of Zero .....	12120	\$260	10/81	stk	-	108	2/50,1/24
(213)579-2300	12196						
Schneider Instrument .....	MB 80	\$165	6/79	stk	18	66	1/50,1/26
Vector Electronics .....	4608	\$64	80	stk	-	54	25/50,43/86 13/26,30/60
(213)365-9661							
	4608-1	\$43.62	80	stk	-	144	25/50,43/86 13/26,30/6
Vero Electronics .....	06-2987E	\$59	-	-	-	84	-
Zendex .....	ZX-905	\$98	1/80	stk	-	84	2/50,1/26
(415)828-3000							
	ZBX-391	\$98	1/82	stk	-	10	-



#### Distinguishing Features

MetaPaket architecture. Foundation and 8086, 8089 IOP, 80130 OSF, 8254's 8259A PIC, 128K RAM with parity, 64K dual ported, 64 EPROM, multimaster interface, large wire-wrap area, 2 iSBX sites, 2 50-pin edge connectors, 12" x 12" form factor.  
3 50-pin wire-wrap headers; optional 2 50-pin, 1 26-pin edge connectors.

Includes 68-pin JEDEC type "A" leadless chip carrier socket with wrappable pin-out.

Full Multibus interface and Multimaster arbitration logic on-board.

3 level gold/gold, optional 2 level gold/gold, 3 level tin/gold. Panel will handle most devices currently available.

Alternate source to iSBC 905, capacity for 108 16-pin DIPs.

SBX MULTIMODULE configuration for prototyping, accommodates 40-pin ICs.

Universal prototype boards with 3 level wire-wrap pins on voltage ground and I/O signal interconnections; allows usage of 14 through 64-pin IC sockets.

Same as WWA-126 except dual row header.

2 level and 3 level wire-wrap pins, extensive ground plane, universal pattern .100 x .300.

Contains complete Multibus "General Purpose Slave Interface," per Intel application note AP-28.

Pre-wired for regulator; dual bus under DIPs for power & ground. Extra I/O connectors. Overall grid of .042" dia. holes on 0.1" centers.

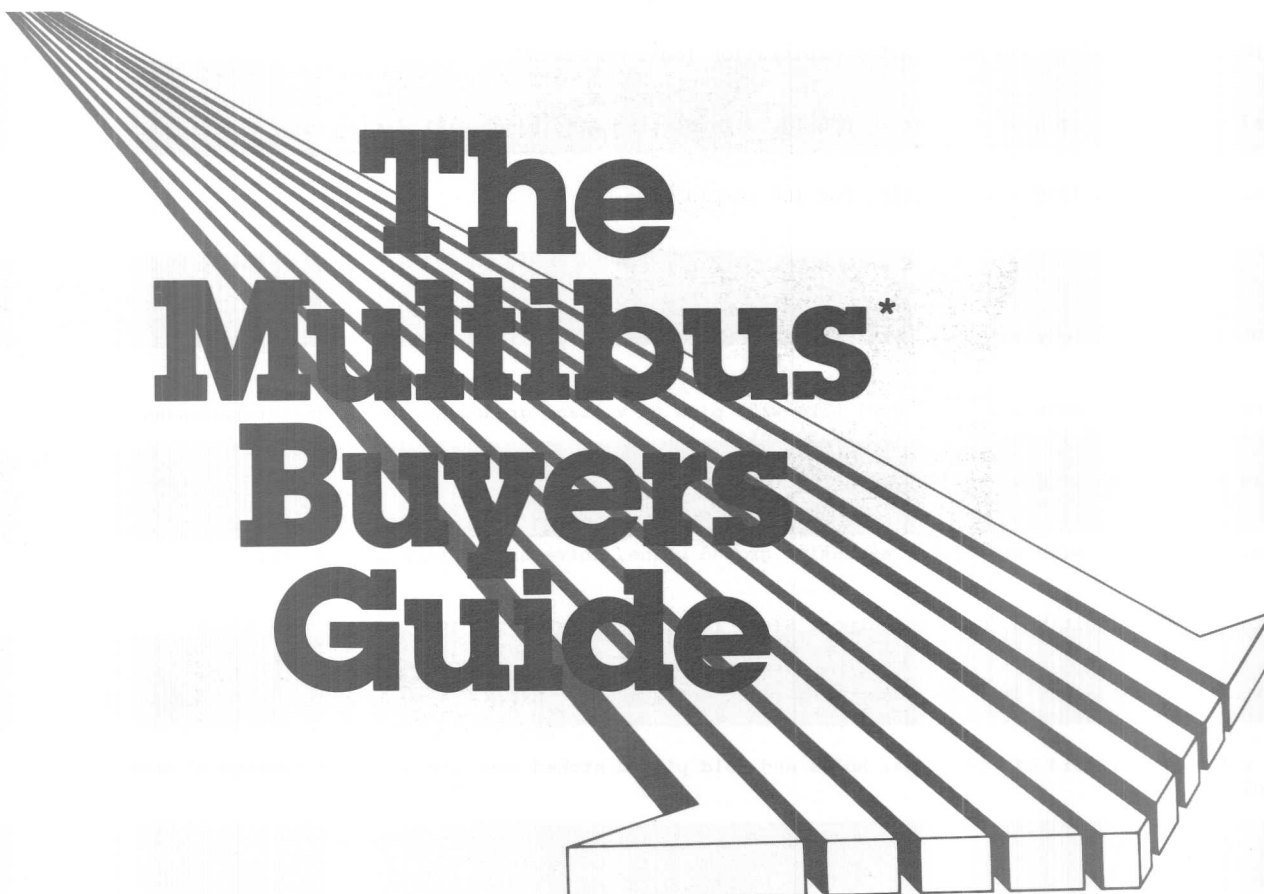
Board with overall grid of .042" dia. holes and gold plated etched contacts only for freedom of component placement.

SBX MULTIMODULE



**IRONOAK COMPANY**

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La Jolla, CA 92037  
(619) 450-0191



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- The S-100 BUS Buyers Guide



# Extender Cards

---

Central Data Corporation  
Comark Corporation  
Douglas Electronics, Inc.  
Electronic Solutions  
ETI Micro  
Hybricon Corp.  
Intel Corporation  
LeCroy Research Systems  
Matrox Electronic Systems  
MDB Systems  
Mupac Corporation  
Monolithic Systems Corp.  
National Semiconductor Corp.  
Prototek, Inc.  
Scanbe, Div. of Zero  
Vector Electronic Company

## Extender Cards

Manufacturer	Model	Price	DFA	Deliv.	Distinguishing Features
Central Data ..... (217)359-8010	B1010	\$100	-	stk	Raises board under test 6.9". All lines incorporated.
Comark Corporation ..... (617)359-8161	MB-EXT	\$ 75	-	-	
Douglas Electronics, Inc. ....	6-DE-16-C	\$ 50	1/81	stk	Universal Multibus extender; FR-4 glass epoxy with gold fingers; all connector contact surfaces are also gold plated.
Electronic Solutions ..... (619)292-0242	80EX-2	\$ 85	-	stk	
	2X80EX-2	\$155	-	stk	Double height extender card.
ETI Micro ..... (415)829-6600	8151	\$105	-	stk	Power switches on-board; ground iso- lation between traces; gold plated connections; support brackets.
Hybricon ..... (617)486-3174	8010ET	\$ 98	6/80	stk	Gold plated; double loop test points, connectors included. Optional ver- sion with card hold-down braces.
Intel Corporation ..... See Sales Office Listing	MDS-610	\$150	-	-	
LeCroy Research ..... (914)425-2000	3500-9	\$130	-	-	Standard 86-pin and an auxiliary 60-pin connector.

continued next page

## Extender Cards

Manufacturer	Model	Price	DFA	Deliv.	Distinguishing Features
Matrox Electronic ..... (514) 735-1182	BEX-1	\$130	-	-	8" high; numbered pins.
MDB Systems .....	MNTL-XBD	\$150	-	-	
Mupac Corporation ..... (617) 588-6110	3153080-01	\$ 89	-	stk	
Monolithic Systems ..... See Sales Office Listing	MSC 8203-01	\$160	-	stk	Multi-layer ground plane to reduce noise; metal frame to hold card under test.
National Semiconductor ..... See Sales Office Listing	BLC-610	\$119	-	stk	Alternate source for MDS-610
	BLC-8610	\$155	-	-	With power isolation.
Prototek Inc. .... (513) 874-5094	ECA-126	\$ 85	3/79	stk	Standard and railed extender cards, railed cards give maximum support to extended boards and have solid ground plane on backside of PC board.
	ECA-126R	\$150	2/81	stk	
Scanbe, Div. of Zero ..... (213) 579-2300	12123	\$110	2/82	stk	
Vector Electronic Company ..... (213) 365-9661	3690-18	\$42.50	82	stk	43/43 installed, gold plated contacts Labelled test points.

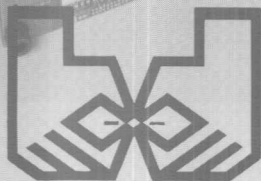
# MULTIBUS\*

## EVERYTHING YOU NEED FOR MULTIBUS COMPATIBLE PACKAGING IN ONE RELIABLE PRODUCT FAMILY

Mupac's family of Multibus compatible card racks offers you the most flexible, compact and reliable Multibus packaging system available today. Card racks and expanders provide 19 different configurations for 2 to 26 active boards. Other parts of the system include wire wrap panels for prototyping and interface applications plus I/O panels for bus extension.

We'll be happy to send you complete details along with our latest catalog. Please write or call toll free **800-225-0398**. (In Massachusetts 588-6110.) TWX (710) 345 8458. Mupac Corporation, 10 Mupac Drive, Brockton, Massachusetts 02401.

\*Multibus Intel Trademark



# MUPAC®

**A SYSTEMS APPROACH TO PACKAGING YOUR SYSTEMS**  
Mupac Corporation, 10 Mupac Drive, Brockton, Massachusetts 02401

## Card Cages

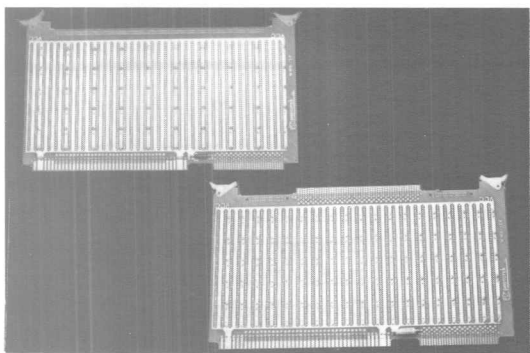


Advanced Micro Devices  
Anitech Systems, Inc.  
Chen Digital Laboratories  
Comark Corporation  
Data Translation, Inc.  
Dawn Technology, Inc.  
Electronic Control Technology  
Electronic Solutions  
Electro-Space Fabricators  
Hybricon Corp.  
Intel Corporation  
Matrox Eletronic Systems  
Mupac Corporation  
Monolithic Systems Corp.  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Optima, Scientific Atlanta  
Prototek, Inc.  
Scanbe, Div. of Zero  
Sibthorp Systmes, Inc.  
Unitrack  
Vector Electronic Company  
Zendex Corporation

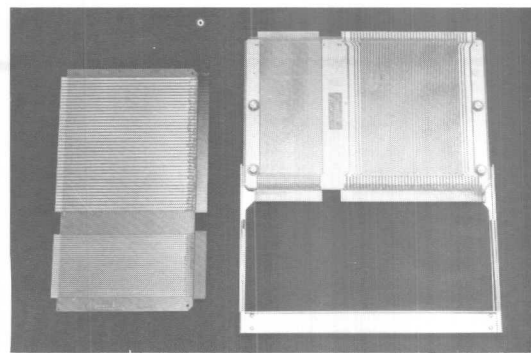


# PROTOTEK<sup>INC</sup>

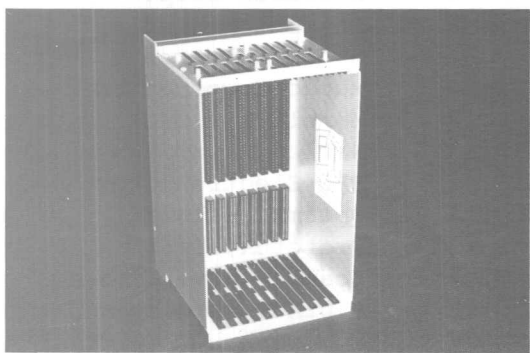
**CAN support your Multibus Developments  
from Prototype through Production**



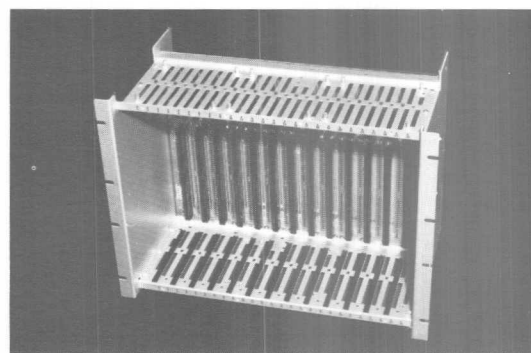
Wire Wrap Cards



Extender Cards

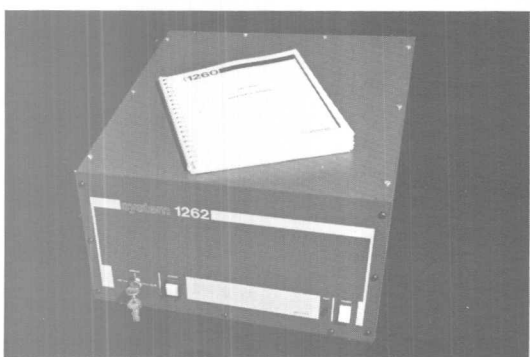


11 Slot Card Cage



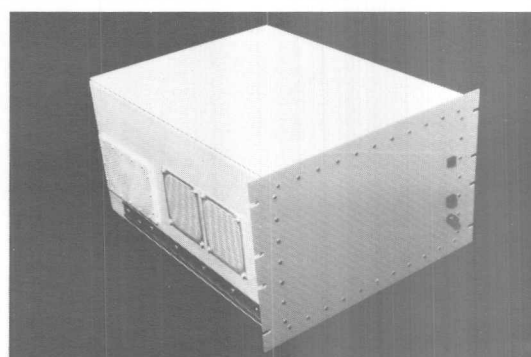
26 Slot Card Cage

• Available with 5, 7, 9, 11, 14, 18, and 26 Positions



Industrial  
Power Ready Chassis

• Meets FCC Class A EMI Requirements



Military EMI/RFI  
Power Ready Chassis

• Meets MIL STD 461 EMI Requirements

• Full Multibus II Support

**Call and discuss your requirements with us**



**PROTOTEK<sup>INC</sup>**

P.O. Box 46512 • Cincinnati, Ohio 45246 • Phone (513) 874-5094

# More Room... More Multibus® Cages.

ONLY FROM  
**ELECTRONIC SOLUTIONS!**

## More Models

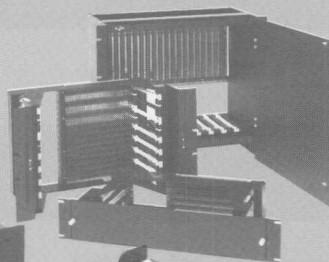
We have more models than all our competitors combined. Choose a cage with:

3, 4, 5, 6, 7, 8, 9,  
12, 14, 15, 16, 20,  
24 OR 26 SLOTS

for the right solution to your problem. We have models with either 0.6" or 0.75" card centers and can even accommodate wirewrap cards.

All models are electrically and dimensionally interchangeable with Intel's iSBC-80® Cages.

## Rack Mounting Too!



## More Room

You get more room for extra cards without increasing overall size, because our design gives you greater inside dimensions.

## More Reliability

All cages are constructed of sturdy, durable anodized aluminum with a single mother board backplane ... a concept that increases reliability and minimizes interconnections.

**THREE  
YEAR  
WARRANTY**

## More Information?

CALL OUR  
TOLL FREE NUMBER  
**(800) 854-7086**

IN CANADA CALL  
TRANSDUCTION, LTD.  
(476) 625-1907

In California Call Collect: (619) 292-0242



**Electronic  
Solutions**

9255 Chesapeake Dr. San Diego, CA 92123  
(619) 292-0242 Telex II (TWX): 910-335-1169

# MULTI-CAGE®

Note: Multi-Cage is a registered trademark of Electronic Solutions. Multibus, Intel and iSBC-80 are trademarks of Intel.

# Card Cages

Note: Slots on 0.6" centers unless otherwise noted.

Manufacturer	Model	DFA	Deliv.	Mother- Board	Backplane Connectors	No. Fans	Termin- ators	Rack- mount	Slots/Price		
									3	4	5
AMD ..... (408)988-7777	95/6440	-	stk	o	N/A	1*	o	*	-	+	-
Anitech Systems Inc. ....	R2175 .75" ctr	3/82	2wk	o	-	-	-	-	-	+	-
Chen Digital Laboratories .....	CCE-6B .75" ctr	3/82	-	-	o	*	o	*	-	\$171	\$179
Comark Corporation .....	CARDPAC-M	10/82	-	o	N/A	2,4,6	o	o	-	+	-
(617)359-8161											
Data Translation .....	DT 511 Series	1/83	stk	o	-	-	o	*	-	\$240	-
(617)481-3700											
Distributed Computer .....	DCS/CC	★9/83	stk	o	o	*	o	-	-	-	-
(617)890-8200											
Dawn Technology, Inc. ....	BPMB-(n)	1/83	stk	o	o	N/A	o	N/A	-	\$110	-
(408)980-1122											
Electronic Control .....	M-CC-6	-	-	o	-	N/A	-	-	-	-	-
Technology											
Electronics Solutions .....	ES-SBC	6/78	stk	o	N/A	*	o	*	-	\$180	\$245
(619)292-0242											
(800)854-7086											
	SBC-753 .75" ctr	6/80	stk	o	N/A	*	o	*	\$190	\$235	\$270
Electro-Space Fabricators .....	ESF 80	-	stk	N/A	N/A	-	N/A	*	-	\$ 35	-
(215)682-7181											



# Card Cages

Prices are in U.S. dollars unless otherwise noted.

Slots/Price			Slots/Price			Slots/Price			Slots/Price			Slots/Price		
6	7	8	9	10	11	12	14	15	16	18	20	21	24	26
\$360	-	-	-	-	-	-	+	-	-	*	-	+	-	-
Can be expanded by use of edge connectors; 18 slots available with 8 slots available for parallel DMA. Optional 6-slot card cage with power supply, 2 fans, \$1060.														
-	-	-	-	-	-	-	+	-	-	-	-	\$900	-	-
16-channel PPR, optional wall mount.														
\$249	-	-	\$363	\$369	-	-	+	-	-	-	-	+	-	-
Contact factory for prices of cages having more than 12 slots.														
-	-	\$395	-	-	-	-	+	-	\$795	\$895	-	+	\$1195	-
Optional front panel.														
-	-	\$350	-	-	-	\$425	-	-	\$625	-	\$690	-	-	\$775
Also available in 0.750" centers. Choice of table mount (rubber feet), horizontal or vertical rackmount.														
-	-	-	\$650	-	-	\$900	-	-	-	-	-	-	-	-
Parallel bus arbitration, B & C clock, low noise, multilayer backplane monitor LED's positive locking connectors, 9-slot has fan, 12-slot does not.														
\$140	-	\$165	\$175	-	-	\$215	+	-	-	-	\$385	+	-	\$385
2-sided full ground plane, includes P1 conns., terminators and provision for voltage regulator.														
\$255	-	-	-	\$295										
\$295	-	\$365	\$395	\$425	-	\$495	\$520	\$545	\$575	-	\$605	+	\$705	\$745
Optional parallel priority resolution circuitry; horizontal and vertical rackmount.														
-	\$380	-	-	-	-	\$615	+	-	\$805	-	-	\$840	-	-
\$193	-	\$205	-	\$220	-	\$232	\$245	-	\$255	\$272	\$284	+	\$309	-
Custom Multibus enclosure, contact the factory.														

continued next page

# Card Cages

Note: Slots on 0.6" centers unless otherwise noted.

Manufacturer	Model	DFA	Deliv.	Mother- Board	Backplane Connectors	No. Fans	Termin- ators	Rack- mount	Slots/Price		
									3	4	5
Hybricon..... (617)486-3174	500 Series	6/82	stk	o	o	*	o	o	-	-	-
	600 Series	8/82	stk	o	o	*	o	-	-	\$175	-
	800 Series	5/82	stk	o	o	*	o	o	-	-	-
Intel Corporation..... See Sales Office Listing	iSBC 604	77	stk	o	o	N/A	o	N/A	-	\$180	-
	iSBC 608	3/82	stk	o	o	Fan Mtg.	o	o	-	+	-
Matrox Electronic..... (514)735-1182	CCB7S	-	-	o	N/A	1	o	-	-	+	-
Monolithic Systems..... (303)770-7400	MSC 8201-16	-	stk	o	N/A	1	o	o	-	+	-
Mupac Corporation..... (617)588-6110	305XXXX-01	7/81	stk	o	N/A	-	o	*	-	\$186	-
	Vertical Style	3/82	-	o	N/A	-	o	o	-	+	-
National Semiconductor..... See Sales Office Listing	BLC-604	-	stk	o	N/A	-	o	-	-	\$190	-
NEC Electronics..... (617)655-8833	AP0900	12/81	stk	o	N/A	-	o	-	-	\$235	-
Optima, Scientific Atlanta.....	Instrumate	12/81	-	-	N/A	-	-	o	-	+	-



# Card Cages

Slots/Price			Slots/Price			Slots/Price			Slots/Price					
6	7	8	9	10	11	12	14	15	16	18	20	21	24	26
-	-	\$538	-	-	-	-	-	-	\$799	-	\$970	-	-	*
4-layer .6" center backplanes PPRC incorporated on backplane P2 Aux. Board option. Vertical mount.														
\$233	-	\$260	\$270	-	-	-	-	-	-	-	-	-	-	-
Vertical mount 1/16" thick double sided, full ground plane. P2 Aux. Board option.														
-	-	-	-	-	-	-	-	-	\$715	\$747	\$783	-	\$855	\$890
28 and 31-slot available to \$980 1/16" thick double-sided backplane P1 and P2 installed PPRC incorporated on backplane.														
-	-	\$360	-	-	-	\$540	+	-	-	-	-	+	-	-
-	-	\$390	-	-	-	-	+	-	\$780	-	-	+	-	-
Note: Eight-slot card cage and backplane with built-in parallel-priority arbitration circuitry. All eight slots accomodate iSBC MULTIMODULE boards. Two slots accomodate iSBX MULTIMODULE boards.														
-	\$680	+	-	-	-	-	\$1360	-	-	-	-	\$2140	-	-
-	\$620	+	-	-	-	-	+	-	-	-	-	+	-	-
Includes P2 connectors optional reset switches and 10 amp. power supply (AC). Bus expansion connectors. Full bus termination card.														
\$250	-	+	\$326	-	-	\$411	+	\$474	(2-slot cage available \$99)	-	-	-	-	\$708
Note: Optional PPR, -5V reg., vertical and horizontal mounting.														
-	-	+	-	-	-	-	+	\$560	-	-	-	+	-	\$745
-	-	\$380	-	-	-	\$570	-	o	o	o	o	-	o	o
\$350	-	\$450	\$495	-	-	-	-	-	-	-	-	-	-	-
Contact the factory for larger models, horizontal or vertical.														
-	-	+	-	-	-	-	+	-	-	-	-	+	-	-

continued next page

# Card Cages

Note: Slots on 0.6" centers unless otherwise noted.

Manufacturer	Model	DFA	Deliv.	Mother- Board	Backplane Connectors	No. Fans	Termin- ators	Rack- Mount	Slots/Price		
									3	4	5
Prototek, Inc. .... (513)874-5094	CWF-126P	3/79	stk	o	o	-	o	o	-	+	\$325
Scanbe..... (213)579-2300	30660	1/79	stk 4wk	o	o	o	o	o	-	\$175	-
Sibthorp Systems..... (606)525-1300	MCC-106	3/81	stk	o	N/A	-	o	-	-	+	-
Unitrack.....	M80	-	-	-	o	-	-	-	-	\$49	-
Vector Electronic..... (213)365-9661	CCK-80	80	stk	*	N/A	-	-	o	-	+	-
	CCK-20	83	stk	* \$165	o	-	-	-	-	\$35	
Zendex..... (415)828-3000	ZX-609C	7/81	stk	o	N/A	2*	o	-	-	+	-

Slots/Price			Slots/Price				Slots/Price				Slots/Price			
6	7	8	9	10	11	12	14	15	16	18	20	21	24	26
-	\$390	+	-	-	\$445	-	+	-	-	\$810	-	+	-	\$1235
Bussed or wire-wrappable 1/8" backplane, punches fan mount support rails and flat or RM end panels, includes P2 connectors. Optionally available in kit form. Parallel priority optional on 2-slot. Standard on 18 slot cage.														
\$220	-	\$255	\$265	-	-	\$315	+	-	\$410	-	\$485	+	-	\$570
Optional: W/W connectors, foot kit, doors, fan mtg. brkts, vertical and horizontal racks, and parallel-priority resolution circuitry. Contact factory on any custom application - new designs or modifications from standard models and units with .750 ctrs. Units with & without backplanes.														
\$350	-	\$365	-	-	-	\$625	+	-	-	-	-	+	-	-
Light weight aluminum, optional P connectors, smooth easy insertion nylon guides, termination networks.														
\$62	-	+	-	-	-	-	+	-	-	-	-	+	-	-
-	-	+	-	\$89.55	-	-	+	-	-	-	-	+	-	-
Adjustable positions for various card sizes, capacity to 10 cards, plastic guides slide and lock to any spacing. Optional 4608-4-1 Motherboard Gold Plated expansion, \$138.50.														
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Optional fully assembled and tested 4-slot Motherboard Brushe black anodized aluminum, \$165.00 (Model CCK20MB4).														
-	-	-	\$650	-	-	-	+	-	-	-	-	+	-	-
Parallel priority resolution network for Multimaster systems. Optional 2-slot horizontal motherboard requires +5V only, \$295.														

# Power Supplies

---

Electronic Solutions  
EMM/Sesco  
Intel Corporation  
Monolithic Systems Corp.  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Zendex Corporation

## Power Supplies

Manufacturer	Model	Price	DFA	Deliv.	Outputs (A)					Distinguishing Features
					+5	-5	+12	-12	+24	
Electronic Solutions ..... (619) 292-0242 (800) 854-7086	MP-514	\$450	-	stk	14	.9	2	.9	-	Overvoltage protection, remote sensing for +5V; Optional RM.
	MP-530	\$625	-	stk	30	1.75	4.5	1.75	-	Optional RM.
EMM/Sesco .....	SECS 80/PS 115	\$4200	-	-	25	.9	2	.8	-	MIL-Spec.
	SECS 80/PS 28	\$3500	-	-	14	.9	2	.8	-	MIL-Spec.
Intel Corporation ..... See Sales Office Listing	iSBC 635	\$610	-	-	14	.9	2	.8	-	
	iSBC 640	\$825	-	-	30	1.75	4.5	1.75	-	
	iSBC 645	\$1120	-	-	15	1	3	1	-	
Monolithic Systems ..... (303) 770-7400	MSC 8202	\$550	-	-	18	1.2	2.4	1	-	
National Semiconductor .... See Sales Office Listing	BLC-635	\$554	-	stk	14	.9	2	.8	-	Alternate source for iSBC 635.
	BLC-665	\$825	-	stk	30	1.75	4.5	1.75	-	
NEC Electronics ..... (617) 655-8833	APO950-030	\$495	12/81	stk	14	.9	2	.8	-	
	APO950-031	\$695	12/81	stk	30	1.75	4.5	1.75	-	
Zendex ..... (415) 828-3000	ZX-635	\$525	1/80	stk	14	.9	2	.8	-	Replaces SBC 635.
	ZX-640	\$725	1/80	stk	30	1.75	4.5	1.75	-	Replaces SBC 640.



# NEED A BETTER MULTIBUS CAGE?



## SCANBE CAN BE...YOUR ANSWER

The answer is as close as your telephone. Scanbe's low noise, high quality Micro-File™ accepts all Multibus™ cards and is immediately available in 4, 6, 8, 9, 12, 16, 20 and 26-slot versions. These models come with or without backplanes and feature • rugged, anodized aluminum construction • Deep-Trak™ nylon guides • local distributor stock • custom applications. Call today for more information and a free Design Guide.

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*The Packaging People*

INDUSTRIAL TOUGH AND AFFORDABLE

MULTIBUS CHASSIS FROM ETI MICRO

## Chassis

AMD  
AMTELCO  
Anitech Systems, Inc.  
Bit-3 Computer Corp.  
Central Data Corporation  
Century Computer Corporation  
Clayton Industries  
Comark Corporation  
Cosmos Systems, Inc.  
Distributed Computer Systems  
Electronic Control Technology  
Electronic Solutions  
ETI Micro  
Forward Technology, Inc.  
Heurikon Corporation  
Intel Corporation  
Mesa Technology Corp.  
Monolithic Systems Corp.  
National Semiconductor Corp.  
NEC Electronics U.S.A.  
Panlmatic Company  
Prototek, INC.  
Sibthorp Systems, Inc.  
Thomas Engineering Co.  
TITN, Inc.  
Zendex Corporation

# INDUSTRIAL TOUGH AND AFFORDABLE

## MULTIBUS™ CHASSIS FROM ETI MICRO

The ETI Micro Multibus Chassis is not just another pretty face. Behind the stylish exterior you'll find a rugged, sophisticated package.

ETI Micro offers a family of tabletop/rackmount chassis with integrated power supply that includes 9-slot, 15-slot, and 23-slot models.

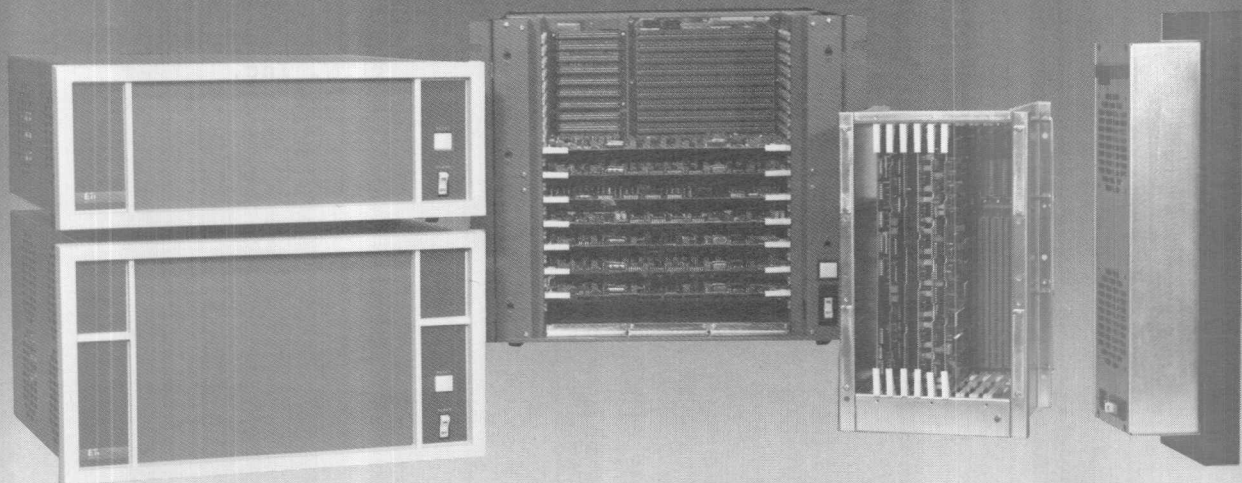
Welded steel construction provides an efficient EMI shield for the electronics. The use of welded seams, instead of screw assembly, assures a rugged stress-resistant enclosure.

For applications requiring NEMA enclosures, ETI Micro offers 9-slot and 23-slot models, featuring heatsink mounted power supplies.

All models accommodate parallel and serial bus priority.

Rugged and affordable . . . order yours now!!!!

Quantity: 1		
<b>8100</b>	9-slot Chassis	\$1250.
<b>8215</b>	15-slot Chassis	\$1700.
<b>8223</b>	23-slot Chassis	\$2650.
<b>8300</b>	Dual 8" Diskette Chassis (includes two disk drives)	\$2510.
<b>8250</b>	9-slot NEMA Enclosure mounting	\$1180.
<b>8263</b>	23-slot NEMA Enclosure mounting	\$2105.



**ETI**  
MICRO

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MULTIBUS is a trademark of Intel Corporation



Finally there's a system enclosure that is designed and manufactured with the thoroughness and care you expect in your Multibus system. It's Electronic Solutions' new Multichassis™.

- 9, 10 or 15 slots, 0.6" spacing
- 7 or 12 slots, 0.75" spacing
- Hefty multi-output power supply
- Cool operation even with high-density boards

There's a field-proven card cage and back-plane, plus full RFI filtering, locking front panel function switch, power fail detection, and quiet dual cooling fans with quick-change filters.

And best of all, the removable front panel lets you easily customize the Multichassis to match your company color and logo.

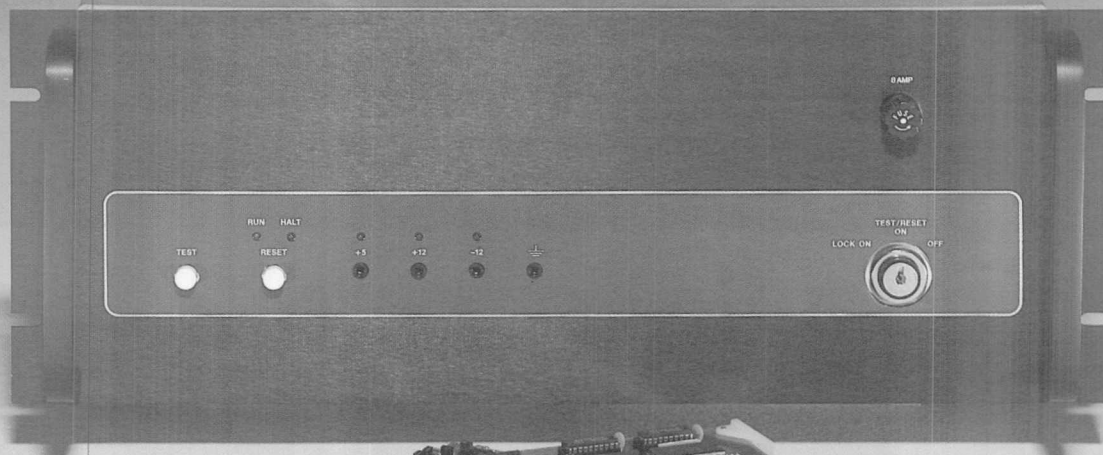
So treat your Multibus system to an elegant but affordable new home—the Multichassis by Electronic Solutions. Call us today for full specifications and prices.



9255 Chesapeake Drive  
San Diego, CA 92123  
Call toll free (800) 854-7086  
in California (800) 772-7086



# Home Sweet Home for Your Multibus\*



\*Multibus is a trademark of Intel Corp.

# Chassis

Manufacturer	Model	Price	DFA	Deliv.	Capacity (Slots)	Reset SW	P/S Output in Amperes					Fan(s)
Advanced Micro Devices ... (408)988-7777	Am95/ 6450	\$1725	-	stk	6	o	20	5	1.5	1.5	N/A	2
	Am95/ 6452A	\$2825	-	stk	14	o	40	1	3	3	-	4
AMTEL CO..... (608)221-3856	BBB-250	-	3/82	stk	20	o	25	2*	4	4	6*	1
	LBB-078	-	3/82	stk	2	o	4	-	1	1	-	1
Anitech Systems Inc. ....	R1575C	\$1695	2/83	4wk	15	-	20	1	4	4	-	-
Bit-3 Computer Corp. .... (612)881-6955	301	\$1300	*9/83	stk	6	o	20	3	4	4	N/A	2
Central Data ..... (217)359-8010	C1000	\$2240	3/80	stk	15	o	40	-	3.4	3.4	N/A	1
	C2000	\$2500	5/83	30da	15	o	50	-	6	6	N/A	4
Century Computer ..... (214)233-3238	V801	\$ 400	-	30da	6 8*	-	-	-	-	-	-	-
Clayton Industries ..... (213)443-9381	-	\$2195	9/82	-	12	-	10 20*	-	2.5	1.5	2	3
Comark Corporation ..... (617)359-8161	DISKSTOR M	\$1695	9/81	-	8 16*	o	25	1.5	4	4	4	3
	PC80A	\$1195	10/79	-	9	o	25	1	4	4	4	2
	CARDPAC MP	\$1095	10/82	-	8	o	25	1.5	4	4	4	2
	PC280	\$2495	7/80	-	18	o	50	2	8	3.7	N/A	2
Cosmos Systems, Inc. ....	CMT-CHA	\$3400	1/82	-	9	o	15	.5	3.4	2.5	N/A	1



Chassis

Dimensions (in.)			Rackmount	Slides	Distinguishing Features
Height	Width	Depth			
5.25	19	19.25	o	o	Metal enclosure front panel access.
10.5	19	20	o	o	Metal enclosure, front panel access.
10	19	22	o	o	Modular 250W power supply; modular front and rear panels; AUX connectors.
3.5	19	9.5	o	-	Rackmount or free standing, fan cooling, AUX connectors, 78 watt linear power supply.
-	-	-	-	-	
6.5	19.5	19.2	-	-	Desk top chassis that is colored and styled like the IBM PC.
10.5	16.75	22.75	*	*	
10.25	16.25	23.0	*	*	Built-in area for 2 full height 5 $\frac{1}{4}$ " Drives or 4 half-height 5 $\frac{1}{4}$ " drives.
-	-	-	-	-	Backplane is constructed on a multi-layer board with separate internal power and ground planes.
10.5	19	24	*	*	Power supply includes -24V, 2A.
10.5	19	19	o	-	8" Floppy Drive Chassis, control panel w/keylock.
5 $\frac{1}{4}$	19	14.5	o	*	
5 $\frac{1}{4}$	19	14.5	o	-	Available in 16 and 24 slots w/400, 600W power supply, optional front panel, reset sw, status lamps standard.
21	19	14.5	o	*	Optional 8-slots wired to MC P2 for parallel DMA bus arbitration.
7	19	25	*	-	

continued next page

# Chassis

Manufacturer	Model	Price	DFA	Deliv.	Capacity (Slots)	Reset SW	P/S Output +5	Output -5	in Amperes +12	-12	+24	Fan(s)
Distributed Computer ..... (617)890-8200	ICM/86	\$2000	1/81	stk	12	o	35	1.0	4.0	1.0	N/A	1
	DCS/80- BFP	\$1500	-	-	9	-	o	o	o	o	N/A	-
Electronic Control ..... Technology	-	\$1795	82	-	10	o	-	-	-	-	-	3
Electronic Solutions ..... (619)292-0242 (800)854-7086	MC-609	\$1895	6/82	stk	9	o	40	.15	3	2.8	N/A	2
	MC-6010	\$1295	5/83	stk	10	o	30	-	3	3	N/A	2
	MC-757	\$1895	8/82	stk	7	o	40	.15	3	2.8	N/A	2
	MC-6015	\$2495	5/83	stk	15	o	40	.15	3	2.4	N/A	2
ETI Micro ..... (415)829-6600	8100	\$1250	3/81	stk	9	o	30	1.75	4.5	1.75	N/A	2
	8300	\$ 945	3/81	stk	N/A	o	-	-	-	-	o	1
	8215	\$1700	9/82	stk	15	o	30	1.75	4.5	1.75	N/A	2
	8223	\$2650	83	stk	23	-	50	-	3.4	3.4	N/A	o
	8250	\$1180	-	stk	9	o	25	-	4	3	3	1
	8263	\$2105	-	stk	23	o	50	-	5	5	N/A	3
Forward Technology ..... FT-CHP		\$1295	-	-	6	o	20	-	-	-	N/A	-

Chassis

Dimensions (in.)			Rackmount	Slides	Distinguishing Features
Height	Width	Depth			
17	19	12	o	-	Nema swing rack enclosure option; 18-slot option with 70 amp power supply.
-	-	-	o	-	Has blank front panel.
9.5	16	19	*	-	Switching power supply.
7	19	17.5	o	-	Full featured control panel; power fail detection; .6" card centers. Optional custom labeled panel.
7	19	17.5	o	o	Front loading, 3 output switching power supply.
7	19	17.5	o	-	Same as 609 except .75" card centers.
10.5	19	22	o	o	
6.9	19	20	o	*	Includes EMI filter, switched duplex outlet, has optional P2 backplane; can accommodate ballbearing slides.
-	-	-	o	-	Diskette Chassis, 90W power supply.
10.4	19	20	o	*	Same features as 8100; Accommodates parallel bus priority.
15.7	19	20	o	*	Includes card cage, power supplies, fans EMI filter, optional P2 backplane, supports parallel bus priority.
-	-	-	o		Includes EMI filter. Welded 16-gauge steel. Clear zinc plating.
-	-	-			Includes EMI filter. 10 amp circuit breaker with time delay.
-	-	-	-	-	Table-top enclosure.

continued next page

# Chassis

Manufacturer	Model	Price	DFA	Deliv.	Capacity (Slots)	Reset SW	P/S Output +5	-5	+12	-12	+24	Fan(s)
Heurikon Corporation ..... (608)271-8700	MLZ-804	\$1495	-	-	4	o	o	o	o	o	N/A	1
	MLZ-806	\$1695	83	-	6	o	o	o	o	o	N/A	1
	MLZ-814	\$2500	-	-	14	o	o	o	o	o	N/A	1
	MLZ-FOX	\$ 865	-	-	N/A	-	-	-	-	-	o	1
Intel Corporation ..... See Sales Office Listing	iCS 80/ Kit 640	\$2235	79	stk	4 12*	o	30	1.75	4.5	1.75	N/A	3
	iSBC 680	\$2990	1/82	stk	6	o	30	2	2.9	3	-	3
	iSBC 655	\$1695	78	stk	4	o	14	.9	2	.8	N/A	2
	iSBC 665	\$1625	80	stk	4	o	15	1	3	1	N/A	1
	iSBC 660	\$1995	70	stk	8	o	30	1.75	4.5	1.75	N/A	2
	iSBC 661-1	\$1995	1/83	stk	8	o	30	1.75	4.5	1.75	N/A	2
	iSBC 661-2	\$-	6/83	stk	8	o	45	-	4.6	6.6	N/A	2
	iCS 80/ Kit 635	\$2043	79	stk	4 12*	o	14	.9	2	.8	N/A	3
Mesa Technology Corp. .... (301)948-4612	iSBC 684	\$ TBA	★10/83	stk	14	o	70	3	6	3	N/A	2
	1010	\$2995	10/82	-	9	o	40	3	1.7	1.7	N/A	2
Monolithic Systems ..... See Sales Office Listing	MSC-8801- 30	\$4293	-	stk	7	o	18	.2	2.0	2.0	2	3
	MSC-8807- 08	\$2828	-	stk	6	o	10	1.0	3.0	3.0	N/A	2



Dimensions (in.)			Rackmount	Slides	Distinguishing Features
Height	Width	Depth			
-	-	-	o	-	Optional desk-top version \$1545.
-	-	-	o	-	Optional desk-top version \$1745.
-	-	-	o	-	Optional desk-top version \$2550.
-	-	-	o	-	8" Floppy Drive Chassis, houses two; desk-top version \$915.
17.4	19	11.5	o	N/A	Rackmount industrial chassis with front access to Multibus boards. Compatible with iSBC 910/920/930 signal termination strips. Expandable to 12-slots, remote sensing for +5V.
12.2	16.8	21.5	o	*	Rackmount or table-top chassis with 300W switching power supply. Powers and houses two standard 8" peripherals. Certified by UL/CSA/FCC for class A data processing equipment.
-	-	-	o	o	Rackmount four-slot chassis with attractive injection molded front panel.
3.5	19	16.25	o	N/A	Rackmount four-slot chassis with switching power supply. On-board real-time clock.
7	17	20	o	o	Rackmount eight-slot chassis with attractive injection molded front panel.
8.75	16.95	19	o tbltop*	*	Rackmount or table-top chassis configurable for either front or rear access to Multibus boards. Input voltage selectable from 100/120/200/240 VAC $\pm 10\%$ . Certified UL/CSA/FCC for Class A.
8.75	16.95	19	o tbltop*	*	Same as iSBC 661-1 except this chassis uses a 325W switching power supply. Power-fail warning with 8 msec hold-up time.
17.4	19	11.5	o	N/A	Rackmount industrial chassis with front access to Multibus boards. Compatible with iSBC 910/920/930 signal termination strips. Expandable to 12 slots, remote sensing for +5V, power-fail warning.
12.0	16.75	21.85	o tbltop*	*	Industry's highest capacity Multibus chassis certified by UL/CSA/FCC for class A data processing.
6.84	19	20.56	o	*	Nine-slot Multibus card cage in 7-inch chassis. High efficiency +5V 40A switching power supply. Switch selectable 115/230V, 50/60Hz operation. Hinged removable front and rear panels. 200 CFM dual fan
11.5	20	18	-	-	2 8" Floppy drives, AC wiring, rear I/O panel for 8DB25, 2 50-pin parallel and 3 BNC connector openings.
8.75	17.75	16	-	-	2 3½" Sony floppy drives. 9" cat and keyboard in portable cabinet w/carrying handle I/O panel with 5DB25 connector opening. Includes CRT controller board.

continued next page

# Chassis

Manufacturer	Model	Price	DFA	Deliv.	Capacity (Slots)	Reset SW	P/S Output +5	-5	+12	-12	+24	Fan (s)
National Semiconductor ... See Sales Office Listing	RMC-660	\$1900	-	stk	8	o	30	1.75	4.5	1.75	N/A	2
	RMC-655	\$1500	-	stk	4	o	14	.9	2	.8	N/A	2
NEC Electronics ..... (617)655-8833	SPO 960	\$1895	2/82	30da	6	o	14	.9	2	.8	N/A	2
Panlmatic Company ..... (312)439-4030	796	\$1645	12/82	stk	4	o	15	.7	3	2	N/A	1
Prototek, Inc. .... (513)874-5094	1261	\$2260	4/80	stk 8wk	11	o	50	1.5	5	5	N/A	2
	1262/18	\$2890	10/82	stk 8wk	18	o	50 150*	1.5 -	5 10*	5 10*	N/A	3
	1262/461	\$7700	3/83	stk 12wk	18	o	50 150*	1.5 -	5 10*	5 10*	N/A	2
Sibthorp Systems ..... (606)525-1300	ICP-100	\$2995	3/81	stk 30da	8 6,12*	o	20	3.5	5	3	N/A	*
	TCP-100- MB	\$3450	4/82	stk 30da	6	o	10	.25	3	2	-	1
Thomas Engineering Co. ...	MZ-RMC	\$1750	6/82	-	8	o	-	-	-	-	N/A	2
TITN, Inc. .... (415)348-9181 (612)831-4422	6890	\$1815	80	6wk	4 8,16*	o	20 40,85*	3	3	3	-	4
Zendex ..... (415)828-3000	ZX-655A	\$1467	10/80	2wk	4	o	14	.9	2	.8	N/A	2
	ZX-660A	\$1755	7/80	2wk	9	o	30	1.75	4.5	1.75	N/A	4
	ZX-700F	\$ 950	2/80	2wk	N/A	-	7	1.2	N/A	1.2	3.5	2
	ZX-950	\$2799	-	2wk	9	o	40.5	1.75	4.5	3.25	7.5	4

Dimensions (in.)			Rackmount	Slides	Distinguishing Features
Height	Width	Depth			
7	19	20	o	-	Alternate source for iSBC 660, 12 mo. warranty.
3.5	19	20	o	*	Alternate source for iSBC 655, 12 mo. warranty.
7.2	19	22.1	-	-	Table-top enclosure; 6-slot card cage; power supply; cooling fans; indicators and switches; rear panel connectors.
17	8.5	11.5	-	-	Industrial NEMA panel mount; front panel rotary switch and LEDs on integral I/O port; removable switching supply with filter, power-fail and RTC; pre-punched I/O panel; UL recognized.
8.25	19	19	o	o	Switching power supply; optional 300W power supply; rackmount or stand-alone; with keylock or push-push front panel; connector cut-out rear panel. Optional vertical card cage.
10.5	19	24	o	o	Switching power supply; optional 750W p/s; RM or stand-alone; keylock or push-push front panel; connector cutout rear panel, PPR.
12.2	19	21.5	o	o	Switching p/s, opt. 750W p/s; designed to meet Mil-Std-461; all removable panels gasketed; backplane EMI "D" type connectors.
9	18	15.75	-	-	NEMA panel mounting industrial enclosure; diagnostic front panel; power line filter; power-fail detect/restart circuitry; battery back-up capability for RAM; battery charger; 150W (200W) p/s.
9	18	16.5	-	-	Portable enclosure; slide drawer keyboard assembly; 9" CRT; integral cassette recorder; 152 key "touchpad" keyboard; optional video, RAM, cassette and keyboard control boards.
-	-	-	-	-	150W switching power supply.
3.5	19	10	-	-	
3.5	19	17	o	*	Linear power supply. Includes ZX-904 interrupt control panel.
7	19	17	o	*	Linear power supply. Includes ZX-904 interrupt control panel and a ZX-903 PIO card.
7	19	17.5	o	*	Dual floppy disk drive chassis. Includes all internal and external cables for Shugart SA-801's.
17.5	19	24	o	*	Same as ZX-900 but may be table-top or rackmounted.

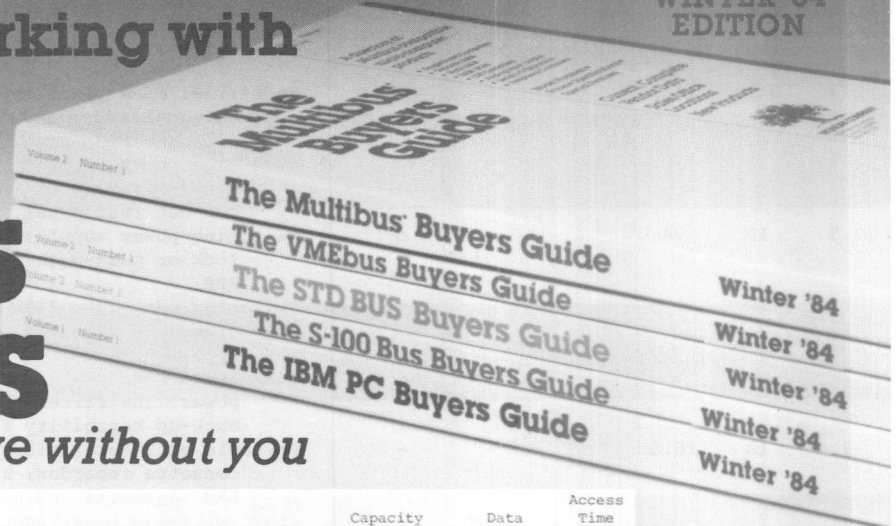
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Manufacturer	Model	Price	DFA	Deliv	Type	Capacity (Kbytes)	Data Retention	Access Time (ns)
Matrix Corporation..... (919)833-2837	7911/CRC-4K	\$295	80	stk	RAM	4 8*	60 da.	300
	8311/RP64	\$225	*6/83	4wk	RAM	64	60 da.	200

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# Multibus Systems

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Forward Technology  
Ikier Technology, Inc.  
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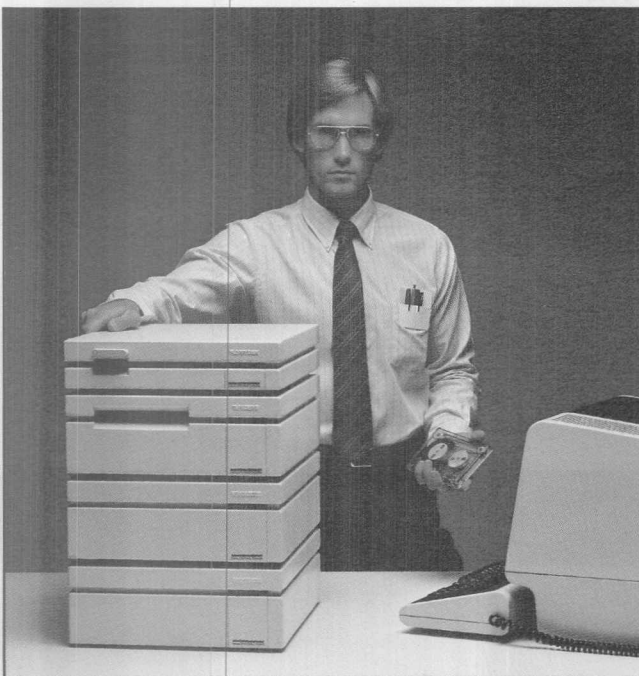
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# Multibus Systems

Manufacturer	Model	DFA	Type	Price \$K OEM LIST	CPU Clock Speed (MHz)	Memory (KB)	Mass Storage (MB)		
							Hard Disk	Floppy	Tape
Altos Computer Systems .. (408) 946-6700	ACS8000	-	Multi-user System	\$7.5	Z80A 4	208	10 12,14*	.5	*
	ACS8600	-	Multi-user System	\$12.5	8086 5	512	20 40*	-	*
	586	12/82	Multi-user System	\$7.99	8086	512 1MB*	10	0	-
Burr-Brown..... (602) 747-0711	CS450	-	Data-Acquisition	\$-	8080	64	NA	.136	*
Bridge Communications.... (408) 446-2981	CS/1	8/82	Ethernet Communica- tions	\$-	68000 8	128	-	0	NA
Callan Data Systems..... (305) 497-6837 (800) 235-7055	CD100M	-	Single user UNIX work station	\$9.95	68000 8	256 1MB*	10 21*	.6	NA
Centigram Corp..... (408) 734-3222	Voice- Ware	12/82	Development System	\$35	Z80A	64	5	.6	NA
Century Computer Corp.... (214) 233-3238 (800) 367-2287	Vanguard 8000	-	Multibus System	\$3.3	8088 8085	128	*	0	NA
CIE Systems..... (714) 660-1800 (800) 437-2341	680	-	Micro Business Computer	\$-	68000 8	256 1MB*	10 300*	-	-
Codata Systems Corp. .... (800) 521-6543	3300	-	Multi-user System	\$9.6	68000	320 1.25*	33 12,84*	1*	10*
Comark Corporation..... (617) 359-8161	MB851	-	Industrial Micro- computer	\$5.2	8085 5	64	10*	*	-
	MB85/285	-	General Purpose	\$11.3	8085 5	64	-	1	.3*
	DISKSTOR-M2	-	DAS, ATE, Office	\$8.59	8086 10	128	NA	0	NA
	DISKSTOR-M3	-	Development System	\$9.3	8085	64	18 36*	NA	NA
	DISKSTOR-M4	-	General Purpose	\$10.6	8086 10	128	18	1	NA
Cosmos Systems, Inc. .... (408) 744-0721	CMS-16	-	Microcomputer System	\$-	68000 8	64 1MB*	-	-	-
	CMS16/UNIX	-	Multi-user, Multi-tasking	\$-	68000 -	256 3MB*	10 40*	1	NA



# emefay2 audhluM

I/O Ports		Expansion		Languages/ Operating Systems		Utilities	Distinguishing Features
Serial	Parallel	Slots					
6	1	-	CP/M, MP/M II, OASIS	-	-	-	
9	1	1	CP/M, MP/M II, OASIS, UNIX	-	-	-	
6	NA	-	MS DOS, PICK, CP/M-86, MP/M-86	BASIC, COBOL, C FORTRAN, PASCAL	-	-	5-user system upgraded to 8, Ethernet and Altos-Net.
1	1	0	-	Ext. BASIC	-	-	ANALOG-DIGITAL I/O, up to 7 I/O boards. Includes internal printer.
8 32*	-	4	-	-	-	-	Designed to provide connection of non-networked devices to an Ethernet local area network.
2	-	4	UNIX V.7	FORTRAN, COBOL, PASCAL	-	-	Five CPU resident timers; integral VT100/VT52 - compatible video terminal; display; 83-key key- board; 8-slot card cage, Ethernet optional.
4	-	0	CP/M	-	-	-	Stand-alone vocabulary generation tool for the General Instrument series of voice synthesizer chips.
2	1	-	CP/M, CP/M-86 MP/M, MP/M-86	-	-	-	Desk-top micro system, 25 x 80 CRT, detached keyboard.
-	-	-	UNIX, REGULUS RM/COS	BASIC, FORTRAN, COBOL, PASCAL	-	-	PRO-IV applications processor.
2 18*	-	-	UNISIS	FORTRAN-77, RM/ COBOL, BASIC, SMC BASIC, APL, PASCAL	-	-	
-	-	-	-	-	-	-	Optional 10MHz 8086 version (Model MB85-M3); environmentally sealed aluminum enclosure; 8-slot card cage; 12" monitor.
1	1	-	CP/M 2.21	FORTRAN, BASIC, PASCAL	-	-	MB85, 9-slot; BM285 18-slot.
1	1	-	MSDOS, CP/M-86*	-	-	-	Includes 8-slot card cage, 3 fans, and 200W switching P/S.
20*	-	0	CP/M	-	-	-	
1	1	5	MSDOS, CP/M-86*	-	-	-	9511A Floating Point Processor; nine interrupt levels; three 16-bit interval timers; 2 SBX connectors.
-	-	-	-	-	-	-	
-	-	5	UNIX V.7	C, PASCAL, FORTRAN BASIC, COBOL	-	-	

continued next page

# Multibus Systems

Manufacturer	Model	DFA	Type	Price \$K OEM LIST	CPU Clock Speed (MHz)	Memory (KB)	Mass Storage (MB)		
							Hard Disk	Floppy	Tape
Cosmos Systems, Inc. .... (408) 744-0721	LYRA	83	Multi-user, Multi-tasking	\$-	68000	64	20	1	NA
	ANTARES	83	-	\$-	68000	64	40	NA	o
	ORION	83	-	\$-	68000	64	474	NA	o
Cyb Systems ..... (512) 458-3224	Multi-box II	6/82	-	\$13.8	68000 8	768 1MB*	27 216*	1	20,45*
	Multi-box III	*12/83	-	\$15	68000 8	1MB 4MB*	*	NA	*
Distributed Computer .... (617) 890-8200	DCS/86	1/82	Industrial System	\$6.9	68010* 8086 5,8	128 1MB*	10* 80*	2	*
	EDGE-86	2/81	Industrial System	\$1.25	8086 -	128	NA	o	NA
Everett/Charles..... (714) 625-5571	ERMAL	-	Visual Inspection System	\$-	-	-	-	-	-
Excelan Inc..... (408) 945-9526	Nut-cracker	*11/83	LAN Development	\$49.5	8086	900+	20	.6	-
Fortune Systems Corp. ...	32:16	-	Desktop Computer	\$4.9	68000 -	128 1MB*	*	1	NA
Forward Technology ..... (408) 988-2378	FT-500	12/82	Multi-user Workstation	\$17	68000 10	256 1.5MB*	20	-	20
	FT-3000	5/82	Multi-user Desk Top Computer	\$23	68000 10	256 1.5MB*	84	-	20 9-trk*
Ikier Technology, Inc. ... (617) 924-3113	EAGLE-1	3/82	Graphics System	\$24	8086	-	10	1	NA
Imaging Technology Inc... (617) 938-8444	IP-512	83	Image-processing	\$8.5	-	256	-	-	-
Intel Corporation ..... See Sales Office Listing	Series IIE	-	Development System	\$12.5	8085	64	- 35*	.25 1MB*	NA
	iMDX 557	-	Development System	\$7.5	8086 8	256	-	-	NA



# Multiple Systems

I/O Ports		Expansion Slots	Operating Systems	Languages/ Utilities	Distinguishing Features
Serial	Parallel				
8	-	5	UNIX V.7	FORTTRAN, COBOL, BASIC, C, PASCAL	
0	-	3	UNIX V.7	-	
8	0	0	UNIX V.7	-	Floating point array processor, Ethernet option.
10 18*	-	-	UNIX V.7 Sys III or Sys V Re: II	FORTTRAN, Pascal, C, ADA, BASIC, COBOL	Packaged software includes Word Processing, Spread- sheets, Data Base Systems, Menu Management pro- gram, and ISAM record management.
14	-	-		-	
3	3	6/9	CP/M-86, CC CP/M MPM-86 MSDOS RMx86	FORTTRAN PASCAL C, BASIC, PL/1	Dual 8" floppy system, optional 5¼" max 4 drives, optional 48MB Winchester, 24MB fixed, 24MB removable cartridge. Burned-in screened ports.
3	2	2	CP/M-86	FORTTRAN-77,MS-DOS, MPM/86 MBASIC,CBASIC- 86,PASCAL,COBOL	DMA floppy controller controls up to 4 drives.
-	-	-	-	-	
-	-	-	-	-	Includes external 100cps matrix printer with graphics capabilities.
-	-	-	UNIX	-	
2 10*	-	3	XENIX (V.7 UNIX)	C,FORTTRAN-77, PASCAL,BASIC,APL, LAN Support	Uses FT-68X with DMA into no-wait-state local memory. Optional Graphics Workstation.
2 18*	-	5	FT-500	FT-500	Uses FT-68X with DMA into no-wait-state local memory. Optional Graphics Workstation.
4	-	-	CP/M-86,MP/M 86	FORTTRAN,C,BASIC	High resolution (1024 x 800pixels); 16 grey levels; bit mapped raster display, non-interlaced; 17" D monitor; Optional 8087 Floating point processor.
-	-	-	-	-	
2	1	-	ISIS-II	-	CREDIT CRT-based text editor, 8080/8085 Macro- assembler.
-	-	-	ISIS-II	-	Upgrades Series IIE to Series III; designed for iAPX 86/88 microprocessor development.

continued next page

# Multibus Systems

Manufacturer	Model	DFA	Type	Price \$K OEM LIST	CPU	Memory (KB)	Mass Storage (MB)		
					Clock Speed (MHz)		Hard Disk	Floppy	Tape
Intel Corporation ..... See Sales Office Listing	SYS 380-2R	*1/84	OEM Supermicro Sys.	\$27.85	80286/287 6MHz	512KB ECC 1MB*	35MB Expandable	1MB	NA
	SYS 380-2X	*1/84	OEM Supermicro Sys.	\$27.85	80286/287 6MHz	512KB ECC 16MB*	35MB Expandable	1MB	NA
	SYS 380-2	*1/84	OEM Supermicro Sys.	\$26.15	80286/287 6MHz	512KB ECC 16MB*	35MB Expandable	1MB	NA
	SYS 86/380R	8/82	OEM Micro System	\$25.925	8086/87 5MHz	384KB 1MB*	35MB Expandable	1MB	NA
	SYS 86/380X	8/82	OEM Micro System	\$27.2	8086/87 5MHz	384KB 1MB*	35MB Expandable	1MB	NA
	SYP 86/380	*7/83	OEM Micro System	\$24.36	8086/87 5MHz	384KB 1MB*	35MB Expandable	1MB	NA
	SYS 310-5MR	*3/84	OEM Supermicro Sys.	\$10.88	80286/287 6MHz	512KB ECC 1MB*	10MB	320KB	NA
	SYS 310-5MX	*3/84	OEM Supermicro Sys.	\$10.88	80286/287 6MHz	512KB ECC 16MB*	10MB	320KB	NA
	SYP 310-5	*3/84	OEM Supermicro Sys.	\$8.42	80286/287 6MHz	512KB ECC 16MB*	10MB	320KB	NA
	SYS 310-3R	*10/83	OEM Micro System	\$9.100	8086/87 5MHz	640KB 1MB*	10MB	320KB	NA
	SYP 310-3	*10/83	OEM Micro System	\$7.400	8086/87 5MHz	640KB 1MB*	10MB	320KB	NA
	SYP 310-2	*10/83	OEM Micro System	\$6.55	8086/87 5MHz	256KB 1MB*	10MB	320KB	NA
	SYP 310-1	*10/83	OEM Micro System	\$4.25	8086 8MHz	128KB	NA Expandable	320KB	NA

I/O Ports		Expansion	Languages/ Operating Systems		Distinguishing Features
Serial	Parallel	Slots		Utilities	
6 Expandable	1	10	iRMX 286R	PL/M, Assembler, Utilities, Diagnostics	High-performance, super-expandable supermicro system. Real-time software supports multi-terminal applications.
6 Expandable	1	10	Xenix 286	C, Assembler, Diagnostics	High-performance, super-expandable supermicro system. Commercial software supports multi-user applications.
6 Expandable	1	10	Hardware only	Hardware only	High-performance, super-expandable application engine. Hardware only.
1 Expandable	1	11	iRMX 86	PL/M, Assembler, Utilities, Diagnostics	Industry-standard, super-expandable micro system. Real-time software supports multi-terminal applications.
1 Expandable	1	10	Xenix 86	C, Assembler Diagnostics	Industry-standard, super-expandable micro system commercial software supports, multiuser applications.
1 Expandable	1	11	Hardware only	Hardware only	Industry-standard, super-expandable application engine. Hardware only.
6 Expandable	1	4	iRMX 286R	PL/M, Assembler Utilities, Diagnostics	High-performance, supermicro with real-time software; supports multi-terminal applications. Compact package.
6 Expandable	1	4	Xenix 286	C, Assembler Diagnostics	High-performance supermicro with commercial software, supports multi-user applications; compact package.
2 Expandable	1	4	Hardware only	Hardware only	High-performance supermicro application engine. Hardware compact package.
1 Expandable	1	4	iRMX 86	PL/M, Assembler Utilities	Industry standard micro system supports real-time applications. Compact package.
1 Expandable	1	4	Hardware only	Hardware only	Industry standard application engine. Compact package.
1 Expandable	1	5	Hardware only	Hardware only	Industry standard application engine. Compact package.
1 Expandable	1	6	Hardware only	Hardware only	Industry standard floppy-based application engine. Compact package.

\*Note: Maximum addressable RAM.

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# Multibus Systems

Manufacturer	Model	DFA	Type	Price \$K OEM LIST	CPU Clock Speed (MHz)	Memory (KB)	Mass Storage (MB)		
							Hard Disk	Floppy	Tape
Intellimac, Inc. .... (301)984-8000	IN/7000M	10/82	General Purpose Microcomputer System	\$46.6	68000 8	256 1MB*	160	NA	o
	IN/7000K	3/82	General Purpose	\$22.3	68000 8	256 512*	16	*	*
Monolithic Systems Corp.. See Sales Office Listing	MSC8801	-	General Purpose	\$6.26	Z80 4 80186*	64 1MB*	- 10,20*	2	-
	MSC8805	83	Multi-user/ Processor	\$12.75	Z80 4	64/ user	10 20*	1	-
	MSC8806	83	Test Station	\$5.75	Z80 4	64	10*	1 4*	-
	MSC8807	83	Portable Micro- Computer	\$3.9	Z80 80186*	64 1MB*	-	2	-
NCR..... (800)222-1235	Tower 1632	83	Business Micro- computer	\$6.9	68000 10	o 2MB*	84*	1*	*
NEC Electronics USA..... (617)655-8833	NDS/ SP0990	6/82	Development System	\$-	8080	-	o	2	NA
Omnibyte Corporation .... (312)231-6880	OB68K/ SYS	-	Software Develop- ment System	\$10.2	68000 10	128	20 80*	1	NA
Pacific Microcomputers .. (619)436-8649	PM200	83	Multi-user System	\$12.5	68000 10	256 1.5MB*	20 60*	1	45*
	PM100	82	UNIX Workstation	\$13.9	68000 8	256 1MB*	20 80*	1	NA
	PM400	83	UNIX Workstation (Multi-user)	\$29.9	68000 10	256 1.5MB*	84 320*	-	o
Phoenix Computer ..... Graphics (318)234-0063	1024	10/82	Color Graphics System	\$23	8086/87	128 768*	10 30*	1	o
Raster Graphics, Inc. ... (503)620-2241	RG-808	*12/83	General	\$5.3	Z80A 4	64	2	-	-
Relms..... (408)732-5520	Icebox	-	Development System	\$9.8	-	256	-	-	-

I/O Ports		Expansion	Languages/ Utilities		Distinguishing Features
Serial	Parallel	Slots	Operating Systems		
8	-	-	UNIX V.7, ADA	FORTRAN-77, COBOL, PASCAL, C	21-slot chassis; 8 to 16 Busmasters; 1MB error-detection and correction memory on the lens.
8	-	-	UNIX, ROS	-	ADA development.
2	-	6	CP/M-80	-	7-slot chassis; optional processors - operating systems. Optional floppy controller version.
5*	1*	5*	RMX-86*		
			MPM-80*		
2+	1/	16	CPN05-80	-	Single user base system expandable to 16 users with processor/user.
3/user	user				
1	-	14	CP/M-80	-	15-slot chassis, optional built-in Winchester, custom configurations available.
2	2	3	CP/M-80	-	Includes 6-slot chassis, 9" CRT, Keyboard and CRT controller, optional processors and operating systems.
			CC CP/M-86*		
2	-	-	RMX 86*	COBOL, Business BASIC, FORTRAN, C	Optional expansion units, memory, I/O; includes 32KB ROM for system start-up, initialization and diagnostics.
			Derived from UNIX		
5	0	-	CP/M	-	Supports 4-bit and 8-bit microcomputers such as uCOM-4, uPD7500, uCOM-87 and 8048.
2	2	6	MSP*, IDRIS* Polyforth*	BASIC, PASCAL C	
10	-	6	UNIX	C, Assembler, "VI" Editor, Berkeley CSH, PASCAL, ETC*	Fwd. compatible to dual port and 68010 CPU. No-wait-state RAM. Modular design. Desk top cabinet (maint. friendly.) Ethernet available.
18*	-	5	UNIX	-	Self-contained in video display terminal multi-user available. (O.E.M. quantity discount available.)
2	-				
10*					
10	-	7	UNIX	-	DEC look-alike cabinetry available.
1	2	2	CP/M-86	C, BASIC, PASCAL, FORTRAN, PL1, Assembler	High resolution (1024 x 1024 x 8); "stand-alone" or integrated as a peripheral to a host; Optional "Graphics Board Set."
-	-	7	-	-	8-slot card cage, 7 spares, CP/M 2.2, 2 Shugart 801 8" Floppy drives, heavy duty power supply. Includes Televideo 910 terminal.
4	1	-	-	-	Supports IEEE-796, IEEE-488, self-diagnostic, programmer interface.

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# Multibus Systems

Manufacturer	Model	DFA	Type	Price \$K	CPU Clock Speed	Memory	Mass Storage (MB)		
				OEM LIST	(MHz)	(KB)	Hard Disk	Floppy	Tape
SBE, Inc. .... (415)652-1805	SBE200	4/83	Development System	\$8.8	68000 10	512	*	*	NA
Scientific Micro..... Systems, Inc. (415)964-5700	MDX8017	12/82	General Purpose Microcomputer System	\$8.6	86/30 5,8	128 512*	11.3 16.9*	1.2	NA
	DSX8017	3/82	General Purpose Microcomputer System	\$8.6	86/30	128 640*	*	1 2,4*	NA
Sibthorpe Systems, Inc.... (606)525-1300	ULTIMA 2000	-	Automation Control	\$-	-	-	-	-	-
Summagraphics Corp.....	SG-48-BL	-	Microcomputer/ Digitizer	\$7.5	-	-	-	-	NA
Sun Microsystems, Inc.... (415)960-1300	100U	6/82	UNIX Workstation	\$15.4	68010 10	1 2MB*	84 169* 474*	-	NA
The Logical Micro-..... computer System (312)580-0250	System One		General Purpose	\$15	16032 10	512 1MB*	19.9 46*	*	*
Vermont Microsystems Inc. (802)655-2860	VM-8870	4/83	Graphics Work- Station	\$5.95	8088/8085 8/2	24/16	NA	NA	NA
	VM-8890	★10/83	Graphics Computer	\$20	68000 -	512 2MB*	33 84*	1	92
Zendex Corp..... (415)828-3000	95/86RMX	3/83	Multi-tasking Real-Time	\$19	8086/87 5	512 1MB*	40 160*	1 2*	20*
	835	9/80	Development System	\$9	8085 5	64	10* 20*	1	NA
	95/86	4/83	UNIX-like	\$-	8086 8	512 1MB*	40 160	1 2*	20*
	95/36CP/M	3/83	General Purpose	\$9	8086 8	128 1MB*	10* 40*	2	NA
Zentec..... (408)727-7662	Series 2000	-	Business System	\$-	-	64	60*	-	-

I/O Ports		Expansion	Operating Systems	Languages/ Utilities	Distinguishing Features
Serial	Parallel	Slots			
2 *	1	9	CP/M 68K* REGULUS* PolyForth/32*	C, BASIC	
1 4*	1	3	iRMX 86	-	Complete system with FWD8006 controller, 5-slot Multibus backplane, 5¼" Winc. 8" floppy, power. Desk top encl. Preconfig. iRMX-86 86/20 CPU.
-	-	6	iRMX 86	-	Controller, 8-slot Multibus backplane, 8"Winches. & floppy drives, rack or desk encl., & power. Preconfig. iRMX-86, 86/30 CPU, 512KRAM
-	-	-	-	-	Discrete and continuous process control, over 1000 digital I/O, to 32 simultaneous.
1	*	-	-	-	High resolution-accuracy digitizer in large size tablets with both opaque and backlit surfaces. 5 or 16 button cursor.
2	-	4 12*	UNIX 4.2	C,PASCAL FORTRAN, Assembler	7 optional 15-slot chassis, B&W high resolution display, optional Ethernet interface, color display.
8	8*		UNITY	FORTRAN, C PASCAL*PL/1* BASIC* ADA*	
4	-	1	-	INTERACT	System-integrated workstation, graphics language interpreter, debug & trace features, supports CRT, digital tablet, and ASCII or binary host com.
10	-	3	UNIX	C, Assembler, FOR- TRAN-77, COBOL, PAS- CAL,BASIC, DI-3000	Multi-user graphics computer, to three graphics users, networking capabilities, includes DI-3000 CORE 79 Graphics Standard Library.
1	1	5	RMX-86	PLM, FORTRAN, PASCAL, C, ZPP, SOFT-SCOPE	Real-Time, Multi-Tasking, optional Multi-user system. High level source debugger and PROM programmers available. Clock/Calendar.
2	1	7	CP/M	ISIS-II	ISIS compatible. PROM programmers available. CP/M to/from ISIS file translator.
1 5*	1 1*	5	Coherent	C	Mark Williams Coherent Operating System. Clock/Calendar. Highly expandable.
1 2*	1	6	CP/M-86	C, PASCAL MT+ZPP, UDI	Configurable system with choice of disk, memory and I/O size. With UDI, it is compatible with Intel 16-bit compilers and utilities.
-	-	-	UNIX	C, (COBOL, FORTRAN, BASIC)*	

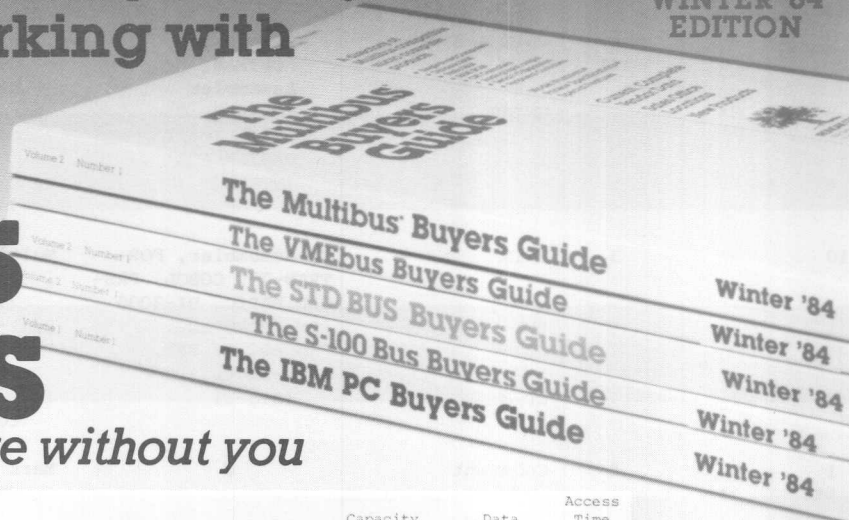
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Matrix Corporation..... (919)833-2837	7911/CRC-4K	\$295	80	stk	RAM	4 8*	60 da.	300
	8311/RP64	\$225	*6/83	4wk	RAM	64	60 da.	200

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East Hanover, NJ 07936.....(201)386-9785

ADAC CORPORATION

70 Tower Office Park

Woburn, MA 01801.....(617)935-6668

Sales Contact: Ben Minsk

Advanced Digital Technology

696 East Trimble Road

San Jose, CA 95131.....(408)866-0500

President: Joel Korelitz

Advanced Micro Devices

901 Thompson Pl. - Box 3453

Sunnyvale, CA 94088.....(408)988-7777

Sales Contact: Gary Treiber

Sales Offices/Representatives:

AL Advanced Micro Devices  
Huntsville.....(205)536-5505

AZ Advanced Micro Devices  
Phoenix.....(602)242-4400

CA Advanced Micro Devices  
El Segundo.....(213)640-3210

Newport Beach.....(714)752-6262

Woodland Hills.....(213)992-4155

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Santa Clara.....(408)727-1300

I<sup>2</sup> Incorporated

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CO Advanced Micro Devices  
Denver.....(303)691-5100

CT Scientific Components  
Cheshire.....(203)272-2963

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Meridian.....(208)888-5708

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IN S.A.I. Marketing Corporation  
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PA Advanced Micro Devices  
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TX Advanced Micro Devices  
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UT R<sup>2</sup> Marketing  
North Salt Lake.....(801)298-2631

WA Advanced Micro Devices  
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WI Oasis Sales, Inc.  
Brookfield.....(414)782-6660

## CANADA

Advanced Micro Devices  
Willowdale, Ontario.....(416)224-5193

Vitel Electronics  
St. Laurent, Quebec.....(514)331-7393

Mississauga, Ontario.....(416)676-9720

Kanata, Ottawa.....(613)863-1776

## AIM Technology

3333 Bowers Avenue #199  
Santa Clara, CA 95051.....(408)727-3711

## Alligator Computer Prod.

P.O. Box 2163  
Woburn, MA 01888.....(617)662-0780

## Alloy Computer Prod.

100 Pennsylvania Ave.  
Framingham, MA 01701.....(617)875-6100

## Altos Computer Systems

2360 Bering Dr.  
San Jose, CA 95131.....(408)946-6700  
(800)946-6700

## Ampex Corporation

Memory Products Division  
200 North Nash Street  
El Segundo, CA 90245.....(213)640-0150

Sales Contact: Andy Nizynski

## AMTELCO

6025 Monona Drive  
Madison, WI 53716.....(608)221-3856  
(800)356-9148

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Three Technology Way  
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25530 Avenue Stanford #208  
Valencia, CA 91355.....(805)257-2184

## Artec Electronics, Inc.

605 Old Country Road  
San Carlos, CA 94070.....(415)592-2740

Astrosystems, Inc.

6 Nevada Drive  
Lake Success, NY 11042.....(516)328-1600  
TWX: 510/223-0411

Augat Inc.

Interconnection Systems Division  
40 Perry Avenue  
P. O. Box 1037  
Attleboro, MA 02703.....(617)222-2202

Sales Contact: John Tisdale

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Ville St. Pierre, Quebec.....(514)367-0101

Concord, Ontario.....(416)669-2262

Calgary, Alberta.....(403)276-9884

Surrey, B.C. ....(604)581-7611

BECO

10 Old Locke Lane  
New Kent, VA 23124.....(804)779-2287

Bit 3 Computer Corporation

8120 Penn Ave, Ste.548  
Minneapolis, NM 55431.....(612)881-6955

Bridge Communications

10440 Bubb Rd.  
Cupertino, CA 95014.....(408)446-2981

Bubbl-tec

Div. of PC/M Inc.  
6800 Sierra Ct.  
Dublin, CA 94566.....(415)829-8700  
TWX/Telex 910-389-6890

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OR Tasco, Inc.  
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WA Tasco, Inc.  
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TX Dyna Marketing  
Houston.....(713)937-0278

Dallas.....(214)243-7994

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Scantec GmbH  
Munchen.....(089)134093  
TELEX: 5213219 SCAN D

## Italy

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Milano.....02-4047648  
TELEX: 335654 TELCOM I

## France

Microel S.A.  
Les Ulis.....907.08.24  
TELEX: 692493

## Switzerland

Micro-System-Technik, AG.  
Zurich 01-520355  
TELEX: 822097 MST CH

## South Africa

Electronic Building Elements  
Pretoria  
TELEX: 3-0181 SA

Burr-Brown Research Corporation

Industrial Systems Products Division  
3631 East 44th Street  
Tucson, AZ 85713.....(602)747-0711

Sales Contacts: Richard Fretwell  
Ed George  
Terry Taylor

Callan Data Systems

2645 Townsgate Rd.  
Westlake Village, CA 91361.....(805)497-6837

CEA

1 Aerovista Park  
San Luis Obispo, CA 93401.....(805)544-5454

Centigram Corp.

1153 Bordeaux Dr.  
Sunnyvale, CA 94086.....(408)734-4012

Sales Contact: Kathleen O'Leary

Central Data Corporation

1602 Newton Drive  
Champaign, IL 61821.....(217)359-8010  
TWX: 910-245-0787

Sales Contact: Norman E. MacGregor

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Huntsville.....(205)882-1691

AZ Holder & Hauer  
Tempe, AZ.....(602)424-4025

CA Qualtech Assoc.  
Palo Alto.....(415)494-9060

CO Eissler Sales & Serv.  
Littleton.....(303)794-1779

CT J. Redding Assoc.  
Acton, MA.....(617)263-8206

DE Dyna Rep.  
Alexandria, VA.....(703)354-1222

FL Synergetic Rep., Inc.  
Largo.....(813)586-2871

GA Synergetic Rep., Inc.  
Lawrenceville.....(404)963-0968

ID Showalter Inst., Inc.  
Bellevue, WA.....(206)455-4922

IL First Rep. Co.  
Elmhurst, IL.....(312)530-2450

IN First Rep. Co.  
Elmhurst, IL.....(312)530-2450

## Central Data Corporation (Continued)

MA J. Redding Assoc.  
Acton.....(617) 263-8206

MI KRW Sales  
Farmington.....(313) 476-6090

MN The Mark Co.  
Minneapolis.....(612) 920-6280

MO System Tech.  
Manchester.....(314) 225-4296

NC Synergetic Rep., Inc.  
Greensboro.....(919) 272-9303

NJ Gebhardt  
Springfield.....(201) 376-4415

OH KRW Sales  
Columbus.....(614) 464-1861

OK System Tech.  
Tulsa.....(918) 665-6340

PA Lynbar Group  
Huntingdon Valley.....(215) 947-3554

KRW Sales  
Oakmont.....(412) 261-1323

PR Synergetic Rep., Inc.  
San Juan.....(809) 762-2688

TX System Tech  
Houston.....(713) 440-8340

UT Eissler Sales & Serv.  
Littleton, CO.....(303) 794-1779

VA Dyna Rep., Co.  
Alexandria.....(703) 354-1222

WA Showalter Inst., Inc.  
Bellevue.....(206) 746-7970

## CANADA

Electrodesign, Ltd.  
Lachine, Quebec.....(514) 636-4838

## INTERNATIONAL

Australia  
Mostyn Enterprises Pty. Ltd.  
Rydalmere, NSW.....

## Belgium

C.N. Rood S.A.  
Brussels.....  
TLX: 84622846

## Central Data Corporation (Continued)

## China

Seed Hong Kong  
North Point, Hong Kong.....  
TLX: 78060313

## England

Data Translation Ltd.  
Berks.....  
TLX: 851849862

## France

Kontron Electronique  
Billacoublay.....  
TLX: 842695673

## Hong Kong

Seed Hong Kong  
North Point.....  
TLX: 78060313

## Ireland

Data Translation Ltd.  
Berks, England.....  
TLX: 851849862

## Israel

Yechiam Yemini  
New York City.....

## Italy

Logitech, S.r.l  
Ivera RO.....

## Japan

Microboards  
Chiba.....  
TLX: 7812993122

## Liechtenstein

Memotec AG  
Langenthal, Switzerland....  
TLX: 84568636

## Luxembourg

C.N. Rood B.V.  
Rijswijk, Netherlands.....  
TLX: 84431238

## Malaysia

Digitech, Pte./Ltd.  
Eu Tong St., Singapore.....

Mostyn Enterprises Pty. Ltd.  
Rydalmere, NSW, Australia

## New Zealand

Technology Marketing, Ltd.  
Auckland.....

## Central Data Corporation (Continued)

## Netherlands

C.N. Rood B.V.  
Rijswijk.....  
TLX: 84431238

## Scotland

Data Translation Ltd.  
Berks, England.....  
TLX: 851849862

## Singapore

Digitech, Pte./Ltd.  
Eu Tong St.....

## Spain

Unitronics, S.A.  
Madrid.....

## Sweden

Reistedt Computer HB  
Akersberga.....

## Switzerland

Memotec AG  
Langenthal.....  
TLX: 84568636

## Wales

Data Translation Ltd.  
Berks, England.....  
TLX: 851849862

## Century Computer

14453 Gillis Road  
Dallas, TX 75234.....(214) 233-3238

## Chen Digital Laboratories

16718 NE 41st  
Redmond, WA 98052.....(206) 881-5031

Sales Contact: Wenwu Chen

## Chrislin Industries

31352 Via Colinas #101  
Westlake Village, CA 91362.....(213) 991-2254

## Christian Rousing Corp.

1337 Thousand Oaks Blvd., Ste. 220  
Thousand Oaks, CA 91362.....(805) 497-6722  
TLX: 910-336-5733

## DENMARK

Christian Rousing A/S.....(2) 65 11 44  
TLX: 35111 cr dk

## UNITED KINGDOM

Christian Rousing Systems  
(UN)Ltd.....(1) 74 92 532  
TLX: 947158 crasuk

## CIE Systems Inc.

2515 McCabe Way, Box 16579  
Irvine, CA 92713.....(714) 660-1800

## CIPRICO INC.

2405 Annapolis  
Plymouth, MN 55441.....(612) 559-2034

Sales Contact: S.A. Stu Reile

## Eastern Regional Sales Office

Norwood, MA.....(617) 769-9720

## Western Regional Sales Office

Sunnyvale, CA.....(408) 730-1187

## Sales Representatives:

## AZ Frontier Technology

Scottsdale.....(602) 998-4438

## CA Data Rep

San Jose.....(408) 279-1212

## Gemini Assoc.

Irvine.....(714) 731-4181

Los Alamitos.....(213) 594-9618

N. Hollywood.....(213) 846-2633

Orange.....(714) 997-7745

San Diego.....(619) 268-1181

Sunnyvale.....(408) 730-1187

## CO Electrodyne

Aurora.....(303) 695-8903

## FL Southeastern First Rep.

Kissimmu.....(305) 846-1306

Melbourne.....(305) 259-6373

North Palm Beach.....(305) 844-3658

## GA Southeastern

Atlanta.....(404) 393-2073

## HI Sam O. Hirota, Inc.

Honolulu.....(808) 535-9971

## IL Mar-Con Associates

Skokie.....(312) 675-6450

## KS Ramsey Associates

Overland Park.....(913) 649-6996

## MD L.G. White

Silver Spring.....(301) 434-1555

## MA Northeast Peripherals

Norwood.....(617) 769-9110



## CIPRICO INC. (Continued)

MI Carter, McCormic & Peirce  
Farmington Hills.....(313)477-7700

MN Micro Resources  
Minneapolis.....(612)830-1454

MO Ramsey Associates, Inc.  
St. Louis.....(314)878-5042

NJ Gebhardt Marketing  
Springfield.....(201)376-4415

NC Southeastern  
Southport.....(919)457-4526

OH Carter, McCormic & Peirce  
Englewood.....(513)836-0951  
Cleveland.....(216)779-5100

OK Cunningham Components Corp.  
Tulsa.....(918)492-0390

OR Northwest Marketing Associates  
Portland.....(503)297-2581

PA Jenkintown.....(215)884-3737  
Carter, McCormic & Peirce  
Pittsburgh.....(412)372-4415

TX Cunningham Components Corp.  
Austin.....(512)459-9100  
Dallas.....(214)233-4303  
Houston.....(713)461-4197

UT Electrodyne  
Salt Lake City.....(801)486-3801

WA Northwest Marketing Assoc.  
Bellevue.....(206)455-5846

## INTERNATIONAL

Diamond Point International....(216)238-0200  
TLX: 433-2049 DIAPT

Clayton Industries

4213 N. Temple City Blvd.  
El Monte, CA 91731.....(213)443-9381

Codata Systems Corp.

285 N. Wolfe Road  
Sunnyvale, CA 94086.....(800)221-2265  
(800)521-6543

Coggins Systems Limited

6725 Jimmy Carter Blvd.  
Norcorss, GA 30071.....(404)447-9202

Comark Corporation

93 West St., P.O. Box 474  
Medfield, MA 02052.....(617)359-8161  
TWX: 710-324-1503

Compumotor Corporation

1310 Ross Street  
Petaluma, CA 94952.....(707)778-1244  
Telex 510-744-2115 (800)358-9068

AR Industrial Controls Assoc.  
Eldorado.....(501)862-2051

CA Motion Systems  
San Jose.....(408)246-0641

Motion Technology  
Northridge.....(213)993-3762

Control Data Corp.

2200 Beckshire Ln.  
Plymouth, MN 55441.....(612)853-6687

Sales Contact: Greg Anderson

Controlsmith, Inc.

658 Brookline Rd.  
Mason, NH 03048.....(603)878-2970

Convergent Technologies Inc.

Santa Clara, CA.....(408)727-8830

Corvus Systems Inc.

San Jose, CA.....(408)946-7700

Cosmos Systems, Inc.

430 Toyama Dr.  
Sunnyvale, CA 94086.....(408)744-0721

Sales Contact: Ray A. Jones

CYB Systems, Inc.

6448 Hwy 290 E., Ste D-106  
Austin, TX 78723.....(512)458-3224

Sales Contact: John Trimble

Datacube, Inc.

4 Dearborn Road  
Peabody, MA 01960.....(617)535-6644

Sales Contact: Lynn F. Gentle

Data Management Labs

2148 Bering Drive  
San Jose, CA 95131.....(408)946-9424

Sales Contact: Donna M. Licot

Data Systems Design

2241 Lundy Avenue  
San Jose, CA 95131.....(408)946-5800

## Sales Representatives:

CA Data Systems Design  
Santa Clara.....(408)727-3163  
Huntington Beach.....(213)493-2561  
(714)891-8512  
Gemini Associates  
San Diego.....(619)268-1181  
CO Westek Data Products  
Denver.....(303)232-2250  
GA Data Systems Design  
Atlanta.....(404)394-7700  
MD Data Systems Design  
Columbia.....(301)596-0464  
MA Data Systems Design  
Norwood.....(617)769-7620  
MN First Rep Company  
Eden Prairie.....(612)944-2097  
NM BFA Corporation  
Albuquerque.....(505)292-1212  
Las Cruces.....(505)524-9693  
NY Crane & Egert Corp.  
Elmont.....(516)872-0800  
OH Data Systems Design  
Cincinnati.....(513)489-6960  
OR E.S./Chase Company  
Beaverton.....(503)641-4111  
PA Data Systems Design  
Blue Bell.....(215)834-1044  
TX Data Systems Design  
Dallas.....(214)980-4884  
BFA Corporation  
El Paso.....(915)542-1762  
UT Westek Data Products  
Salt Lake City.....(801)261-0999  
WA E.S./Chase Company  
Bellevue.....(206)453-0765

## Authorized Stocking Distributors

BFA Corporation

SSE Products

Data Technology Corporation

2775 Northwestern Parkway  
Santa Clara, CA 95051.....(408)496-0434  
TWX: 910-338-2044

Data Translation

100 Locke Drive  
Marlboro, MA 01752.....(617)481-3700  
TLX: 951646

President: Fred Molinari

## Sales Representatives:

CA Thorson West  
Mountain View.....(415)964-9300  
A-F Sales Engineering, Inc.  
Pasadena.....(213)681-5631  
NJ Data Translation  
Dover.....(201)328-7347  
OR Northwest Marketing Associates  
Portland.....(503)297-2581  
TX Data Translation  
Plano.....(214)578-0036

## INTERNATIONAL

Belgium  
C.N. Rood A.S.....027352135  
China  
Imag Industries, Inc.....(408)727-8222  
Chile  
Interlog.....2253689  
Denmark  
Imdata APS.....273 2233  
England  
Data Translation Ltd.....6286 3412  
Finland  
Turion OY.....90 377 787  
France  
Sacasa.....630 68 39  
Greece  
Elecomp Ltd.....9514944  
India  
Sapphire Innovators Pvt.....231040  
Israel  
Dynamicon Ltd.....3-727010  
Italy  
Eledra SPA.....02 34 9751

## Data Translation (Continued)

Japan  
 ASR International.....03437-5471  
 Takachicho Koheki Co.....03244-1111

Netherlands  
 C.N. Rood B.V.....070-996360

New Zealand  
 Anderson Digital Electronics.....693-008

Norway  
 Electronix A/S.....02229850

Peru  
 MBP Ingenieros S.A.....321516

Portugal  
 Ditram Componentes E.....54-5313

Singapore  
 General Engineers Corp.PTE.....2729412

South Africa  
 Electronic Bldg. Elements PTY-27 118161782

Spain  
 Instrumatic.....213199  
 Instrumatic.....2502577

Switzerland  
 Instrumatic AG.....01 7241410  
 Instrumatic SA.....22 360830

Sweden  
 Scancopter AB.....08289425

Taiwan  
 A-Tek Enterprises Co.  
 TLX: 785 8927

West Germany  
 Stemmer Elektronik.....89 806061

Datel

11 Cabot Blvd.  
 Mansfield, MA 002048 (617) 339-9341  
 TLX: 951340  
 TWX: 710-346-1953

Sales Contact: Harlen Batchelder

AL International Scientific Instruments  
 Huntsville.....(205) 533-6880

AZ Tech. Sales, Inc.  
 Phoenix.....(602) 246-1614

CA Datel-Intersil, Inc.  
 Santa Ana.....(714) 835-2751  
 Sunnyvale.....(408) 733-2424

## Datel (Continued)

CO Cleveland Enterprises of Colorado  
 Denver.....(303) 751-3252

CT JBL Associates  
 Hamden.....(203) 281-3161

FL H.A. Inc.  
 Coral Springs.....(305) 752-7520  
 Largo.....(813) 595-8170

GA International Scientific Instruments  
 Atlanta.....(404) 452-0144

HI Adtech, Inc.  
 Honolulu.....(808) 941-0708

IL Sector Engineering Sales, Inc.  
 Elmhurst.....(312) 530-7850

IN Sector Engineering Sales, Inc.  
 Indianapolis.....(317) 842-1120

IA Technical Representatives, Inc.  
 Cedar Rapids.....(319) 393-1300

KS Technical Representatives, Inc.  
 Wichita.....(316) 681-0242

MA Datel-Intersil, Inc.  
 Mansfield.....(617) 339-9341

MI Electro Sales Assoc.  
 Livonia.....(313) 474-7320  
 Portage.....(616) 323-2416

MN J.R. Associates  
 Minneapolis.....(612) 559-5673

MO Technical Representatives, Inc.  
 Earth City.....(314) 291-0001  
 Kansas City.....(816) 756-3575

NM Cleveland Enterprises, Inc.  
 Albuquerque.....(505) 265-7893

NY Astrorep, Inc.  
 Babylon.....(516) 422-2500  
 Liverpool.....(315) 457-0100

NC Everett Bolte Sales  
 Greensboro.....(919) 294-4141

OH Instrumentation Systems, Inc.  
 Cleveland.....(216) 845-8800  
 Dayton.....(513) 294-2838

PA Wyncote Instrumentation Company  
 Glenside.....(215) 572-6500  
 Pittsburgh.....(412) 243-1111

TX Technical Marketing, Inc.  
 Carrollton.....(214) 387-3601  
 Houston.....(713) 777-9228  
 Austin.....(512) 835-0064  
 UT Cleveland Enterprises of Colorado  
 Salt Lake City.....(801) 355-8424  
 VA H.J. Heffernan Company  
 Arlington.....(303) 522-6666  
 WI Sector Engineering Sales, Inc.  
 Milwaukee.....(414) 352-8280

Dawn Technology, Inc.  
 2403 DeLaCruz Blvd.  
 Santa Clara, CA 95050.....(408) 980-1122

Delta Tau Data Systems, Inc.  
 21115 Osborne St.  
 Canoga Park, CA 91304.....(213) 998-2095

Densan Co., Ltd.  
 Meiwa Bldg., 23-11, 1-Chome, Kamitakaido  
 Suginamiku, Tokyo, Japan 168.....03-329-3871

DI-AN Micro Systems Ltd.  
 Mersey House, Battersea Rd., Heaton Mersey,  
 Stock Port, Cheshire SK4 3EA.....601 4429768

Digi-Data Corporation  
 8580 Dorsey Run Road  
 Jessup, MD 20794.....(301) 498-0200  
 TWX: 710-867-9254

Digital Pathways, Inc.  
 1060 East Meadow Circle  
 Palo Alto, CA 94303.....(415) 493-5544

Distributed Computer Systems  
 330 Bear Hill Road  
 Waltham, MA 02154.....(617) 890-8200  
 TLX: 705745

Diversified Technology, Inc.  
 112 E. State St.  
 Ridgeland, MS 39157.....(601) 856-4121  
 TLX: 585326-ERGON INC JKS

Douglas Electronics, Inc.  
 718 Marina Blvd.  
 San Leandro, CA 94577.....(415) 483-8770

Sales Contact: Nancy Lester

DSP Systems Corporation  
 1081 North Shephard St.. M/S-E  
 Anaheim, CA 92806.....(714) 630-1330

CA Qualtech Associates  
 Palo Alto.....(415) 494-9060

## JAPAN

Kyokuto Boeki Kaisha, Ltd.  
 Tokyo  
 Telex: J22440KYOKUBO

## ENGLAND

M.C.P. Electronics Ltd.  
 Middlesex.....(01) 902-5941  
 Telex: 923455MCP G

## FRANCE

Metrologie  
 Asnieres.....(1) 791 44 44  
 Telex: 611488

Edge Micro Systems  
 195 W. El Camino Real  
 Sunnyvale, CA 94086.....(408) 738-4729

Sales Contact: Shun-Ning Wang

EECO Incorporated  
 1601 E. Chestnut Ave.  
 Santa Ana, CA 92702.....(714) 835-6000  
 TWX: 910-595-1550  
 TLX: 67-8420

EG&G Reticon  
 345 Potrero Ave.  
 Sunnyvale, CA 94086.....(408) 738-4266  
 TWX: 910-339-9343

Electro Craft Inc.  
 1600 Second St. So.  
 Hopkins, MN 55343.....(612) 931-2700

Electronic Control Technology

763 Ramsey Ave.  
Hillside, NJ 07205.....(201)686-8080

Eirich Machines, Inc.

663 5th Avenue  
New York, NY 10022.....(416)832-2241  
TLX: 06-964549

Electronic Solutions

9255 Chesapeake Drive  
San Diego, CA 92123.....(619)292-0242  
TLX II (TWX): 910-335-1169

## Sales Representatives:

AL Remco  
Huntsville.....(205)533-3763

AZ Mar Tech Associates, Inc.  
Scottsdale.....(602)994-1285

CA Qualtech North  
Palo Alto.....(415)494-9060

Qualtech South  
North Hollywood.....(213)765-1419

Orange.....(714)639-9820

Mesa Engineering  
San Diego.....(619)278-8021

CT Bell Controls  
Canton.....(203)693-8926

FL Southeastern First Rep  
Melbourne.....(305)259-6373

Kissimmee.....(305)846-1306

Jacksonville.....(904)925-6384

N. Palm Beach.....(305)844-3658

GA Remco  
Atlanta.....(404)447-6937

IL Mar Con Associates, Inc.  
Skokie.....(312)675-6450

IA The Beams Co.  
Des Moines.....(515)255-1148

KS The Beams Co.  
Shawnee Mission.....(913)631-0300

MD Spectro Associates  
Rockville.....(301)279-2010

Spectro Associates  
Annapolis.....(301)261-1984

MI Lowell-Wendt Marketing Co.  
Livonia.....(313)464-2722

## Electronic Solutions (Continued)

MN Micro Resources  
Minneapolis.....(612)830-1454

MO The Beams Co.  
St. Louis.....(314)569-1060

NH Bells Controls  
Nashua.....(603)882-6984

NJ Gebhardt Marketing  
Springfield.....(201)376-4415

NY Gebhardt Marketing  
East Islip.....(516)582-3215

PDQ Associates  
New Hartford.....(315)768-8167

NC Remco  
Raleigh.....(919)847-5079

OH Geotronics  
Cleveland.....(216)526-2535

Columbus.....(614)457-8472

OR Northwest Marketing  
Portland.....(503)297-2581

PA Monument Technical Assoc.  
Jenkintown.....(215)884-3737

TX Acudata  
Houston.....(713)580-2451

Plano.....(214)424-3567

WA Northwest Marketing  
Bellevue.....(206)455-5846

WI Prarie Associates  
Waukesha.....(414)544-1141

Electro-Space Fabricators, Inc.

West High Street  
Topton, PA 19562.....(215)682-7181

EMM/Sesco

P.O. Box 668  
Chatsworth, CA 91311.....(213)998-9090  
TELEX: 69-1404

ETI Micro

6918 Sierra Court  
Dublin, CA 94566.....(415)829-6600

Sales Contact: Alan R. Daniels

## Sales Representatives:

AL Pen-Tech  
Huntsville.....(205)881-9298



ETI Micro (Continued)

CA Applied Micro Technology  
Woodland Hills.....(213)888-2027  
  
Sunnyvale.....(408)730-1289  
  
CO Westek  
Lakewood.....(303)989-1900  
  
CT J. Redding & Associates, Inc.  
Sandy Hook.....(203)426-6736  
  
FL Pen-Tech Associates  
Casselberry.....(305)645-3444  
  
Deerfield Beach.....(305)421-4989  
  
GA Pen-Tech Associates  
Marietta.....(404)424-1931  
  
MD Rep-Troy, Inc.  
Baltimore.....(301)799-7490  
  
MA J. Redding & Associates, Inc.  
Northport.....(516)754-2130  
  
NM BFA Corporation  
Albuquerque.....(505)292-1212  
  
NC Pen-Tech  
High Point.....(919)883-9125  
  
MN Jen-Ray Systems  
Minneapolis.....(612)831-5060  
  
OH Applied Data Management  
Cincinnati.....(513)579-8108  
  
OR Tasco  
Portland.....(503)245-8168  
  
PA Monument Technical Associates  
Jenkintown.....(215)884-3737  
  
TX Acudata, Inc.  
Houston.....(713)488-8195  
(713)350-1771  
  
Plano.....(214)424-3567  
  
UT Westek  
Salt Lake City.....(801)582-1200  
  
WA Tasco  
Bellevue.....(206)453-1414

Evert/Charles Automation

700 E. Harrison  
Pomona, CA 91767.....(714)625-5571  
TWX: 910-581-1210

Excelan

2180 Fortune Dr.  
San Jose, CA 95131.....(408)945-9526

Fairchild Camera and Instrument

3420 Central Expressway  
Santa Clara, CA 95051.....(408)773-2101

Forward Technology Incorporated

2175 Martin Ave.  
Santa Clara, CA 95050.....(408)988-2378

Sales Contact: Paul Ray

Frontier Technologies Corp.

P.O. Box 11238  
Milwaukee, WI 53211.....(414)964-8689

Sales Contact: Dr. Prakash

Garry Manufacturing Company

9 Queen Anne Court  
Langhorne, PA 19047.....(215)943-5220

General Digital Corporation

700 Burnside Ave.  
East Hartford, CT 06108.....(203)528-9041

President: Dr. Russell A. Reiss

Sales Contact: Stuart H. Hoffer

Sales Representatives:

CA Qualtech Associates  
Palo Alto.....(415)494-9060

INTERNATIONAL

Intermark International

Concord, MA.....(617)369-5823

GIC Systems

250 Glenwood Ave.  
Bloomfield, NJ 07003.....(201)743-6800

Graphics Development Laboratories

333 Cobalt Way, Suite 106  
Sunnyvale, CA 94086.....(408)980-7135

Hal-Versa Engineering, Inc.

18597 Paseo Tierra  
Saratoga, CA 95070.....(408)374-2953

President: Howard Halverson

Heurikon Corporation

3001 Latham Drive  
Madison, WI 53713.....(608)271-8700  
(800)356-9602

Sales Contact: Christopher Priebe

Sales Representatives:

CA Qualtech Associates  
Los Angeles.....(213)410-0477  
  
Mesa Engineering  
San Diego.....(619)278-8021  
  
Qualtech Associates  
Palo Alto.....(415)494-9060  
  
GA Magaro and Associates  
Atlanta.....(404)252-6609  
  
MA Daner-Hayes, Inc.  
Waltham.....(617)894-7290  
  
NC Peter Byrne  
Greensboro.....(919)294-4783  
  
OH Applied Data Management  
Cincinnati.....(513)579-8108  
  
TX Acudata  
Houston.....(713)488-8195  
  
Dallas.....(214)424-3567  
  
UT PAR Associates  
Centerville.....(801)292-8145  
  
WI Prairie Associates  
Waukesha.....(414)544-1141

HORUS Computer GmbH

Postfach 800210, KatterbachstraBe 89a  
D-5060 Bergisch Gladbach 2,  
West Germany.....02202/84400

Hybricon Corp.

410 Great Road  
Littleton, MA 01460.....(617)486-3174

President: C. Michael Hayward

Sales Contact: Richard W. Palmer

Sales Representatives:

AL Pen-Tech Associates  
Huntsville.....(205)881-9298  
  
CA Basic Systems Corp.  
Santa Clara.....(408)727-1800  
  
Inglewood, Stocking Rep....(213)673-4300  
  
San Diego.....(619)268-8000

Hybricon Corp. (Continued)

DE Atlantic Technical Sales...(301)879-2236  
  
FL Northern  
Pen-Tech Associates  
Casselberry.....(305)645-3444  
  
Southern  
Pen-Tech Associates  
Deerfield Beach.....(305)421-4989  
  
GA Pen-Tech Associates  
Marietta.....(404)424-1931  
  
IL H. Benjamin Associates  
Glencoe.....(312)835-0150  
  
KS DLE Electronics  
Wichita.....(316)744-2126  
  
MD Atlantic Technical Sales  
Churchville.....(301)879-2236  
  
MN Bohlig & Associates  
Minneapolis.....(612)922-7011  
  
NH Electronic Marketing Assoc.  
Salem.....(603)893-5378  
  
NY Upstate NY  
Precision Sales  
Liverpool.....(315)451-3480  
  
Precision Sales  
Pittsford.....(716)381-2820  
  
Precision Sales  
Binghampton.....(607)648-8833  
  
OH Applied Data Management  
Cincinnati.....(513)529-8208  
  
TX Jim D. Gray Assoc, Inc.  
Dallas.....(214)341-7190  
  
CANADA  
  
Transduction Limited  
Toronto.....(416)625-1907

Ikier Technology, Inc.

42 Pleasant Street  
Watertown, MA 02172.....(617)924-3113

President: Larre Nelson

Dir. Sales: Arnulv Straume

Eas. Reg. Sal. Mgr: David Del Dotto

Mark. Admin: Jean Berry

Ikier Technology, Inc. (Continued)

CA Ikier Technology, Inc.  
Thousand Oaks.....(805)496-5854

Pacific Computer Marketing  
San Pedro.....(213)519-0679  
(213)889-2532

Zytronics  
Santa Clara.....(408)730-1263

CO Davis Associates, Inc.  
Englewood.....(303)741-4843

FL Reynolds Associates  
Cocoa Beach.....

IL Ad Tech, Inc.  
Park Ridge.....(312)692-7320

MA J. Redding Assoc.  
Acton.....(617)263-8206

OR Electronic Tech. Sales  
Hillsboro.....(503)640-8086

TX SCI Sales, Inc.  
Dallas.....(214)931-1487

Houston.....(713)664-1543

VA Dynarep  
Alexandria.....(703)354-1222

WA Electronic Tech. Sales  
Kirkland.....(206)827-8086

CANADA

Transduction  
Mississauga, Ontario.....(312)263-6124  
TLX: 0696137

INTERNATIONAL

W.R. Magnus  
Chicago.....(312)263-6124

Austria

Dan Sommer, Jahnstrasse 49  
W. Germany.....49-611-558-662  
TLX: 8410414587 49-611-597-2171

Belgium

Dan Sommer, Jahnstrasse 49  
W. Germany.....49-611-558-662  
TLX: 8410414587 49-611-597-2171

China

Robin Information Systems  
Hong Kong.....852-5-891-5313  
TLX: 63594 RISHK HX

England

Measurement Systems Ltd.  
Berkshire.....44-0635-45420  
TLX: 85161185 SKYLINE

Ikier Technology, Inc. (Continued)

Germany

Dan Sommer, Jahnstrasse 49  
W. Germany.....49-611-558-662  
TLX: 8410414587 49-611-597-2171

Hong Kong

Robin Information Systems  
Wanchai.....852-5-891-5313  
TLX: 78063594

Ireland

Measurements Systems  
Berkshire, England.....44-0635-45420  
TLX: 85161185 SKYLINE

Japan

MTT Instruments, Inc.  
Tokyo.....03-348-8301  
TLX: 7812324236

Malaysia

Robin Information Systems  
Petaling, Jaya.....

Scotland

Measurements Systems  
Berkshire, England.....44-0635-45420  
TLX: 85161185 SKYLINE

Singapore

Robin Information Systems  
Singapore.....65-273-558  
TLX: 78635732

Switzerland

Dan Sommer, Jahnstrasse 49  
W. Germany.....49-611-558-662  
TLX: 8410414587 49-611-597-2171

Ikon Corporation

2617 Western Ave.  
Seattle, WA 98121.....(206)624-3410

Sales Contact: Bruce A. Bradburn

Imaging Technology, Inc.

400 West Cummings Park, Ste. 4350  
Woburn, MA 01801.....(617)938-8444

Sales Representatives:

CA Northern

Bergis Associates  
Gilroy.....(408)847-0444

Southern

Pacific Computer Marketing  
San Pedro.....(213)519-0679

CO Davis Associates

Englewood.....(303)761-7980

## Imaging Technology, Inc. (Continued)

KS Panatek Tech Sales Assoc.  
Prairie Village.....(913)362-3349

MA Bomara Associates  
Chelmsford.....(617)452-2299

NY EF Sales  
Caledonia.....(716)538-4754

PA Technico  
Trevose.....(215)245-8411

TX SCI Sales, Inc.  
Dallas, TX.....(214)931-1487

WA DPM, Inc.  
Bellevue.....(206)747-3309

## INTERNATIONAL

## Austria

Stemmer Elektronik  
W. Germany.....011-49-806061  
TLX: 8415216425 (STEL D)

## Denmark

Jorgen Andersen Ingeniorfirma  
Glostrup.....02-918888  
TLX: 85535378 (JORGEX DK)

## France

Tekelec Airtronic  
Sevre.....011-33-1-534-7535  
TLX: 842204552 (TKLEC)

## England

Data Translation Ltd.  
Berks.....011-44-6286-3412  
TLX: 851849862 (DATAX G)

## Finland

Jorgen Andersen Ingeniorfirma  
Glostrup, Denmark.....02-918888  
TLX: 85535378 (JORGEX DK)

## Ireland

Data Translation Ltd.  
Berks, England.....011-44-6286-3412  
TLX: 851849862 (DATAX G)

## Israel

M.L.R.N. Electronics  
Tel-Aviv.....011-972-3-796-927  
TLX: 922342107 (RNIS IL)

## Italy

ADC Sistemi  
Milano.....02-487-930  
TLX: 843311271 (PPA MI)

## Japan

ASR Corp. International  
Tokyo.....03-437-5371  
TLX: 7812422723

## Imaging Technology, Inc. (Continued)

## Korea

Applied Engineering Ltd.  
Seoul.....633-3547  
TLX: 78727938 (APPLKOR)

## Norway

Jorgen Andersen Ingeniorfirma  
Glostrup, Denmark.....02-918888  
TLX: 85535378 (JORGEX DK)

## Scotland

Data Translation Ltd.  
Berks, England.....011-44-6286-3412  
TLX: 851849862 (DATAX G)

## Spain

Hardware & Software  
Barcelona.....204-2099  
TLX: 83150612 (HS)

## Sweden

Jorgen Andersen Ingeniorfirma  
Glostrup, Denmark.....02-918888  
TLX: 85535378 (JORGEX DK)

Industrial Micro Applications, Inc.

1425 Blalock, Ste. 208  
Houston, TX 77055.....(713)488-1171

Sales Contact: Bob Watts

Information Development & Applications, Inc.

10759 Tucker Street  
Beltsville, MD 20705.....(301)937-3600

Product Manager: Frank Giuffre

Intel Corporation

5200 N. E. Elam Young Parkway  
Hillsboro, OR 97123.....(503)640-7147

## AL Intel Corp.

Huntsville.....(205)533-9353

## AZ Intel Corp.

Phoenix.....(602)869-4980

## Intel Corporation (Continued)

CA Intel Corp.  
 San Diego.....(714)268-3563

Santa Ana.....(714)835-9642

Tarzana.....(213)708-0333

Santa Clara.....(408)987-8086

Earl Associates  
 San Diego.....(714)278-5441

Mac-I  
 Berkeley.....(415)843-7625

Milpitas.....(408)946-8885

Fountain Valley.....(714)839-3341

Santa Monica.....(213)452-7611

Woodland Hills.....(213)347-5900

CO Intel Corp.  
 Denver.....(303)321-8086

CT Intel Corp.  
 Danbury.....(203)792-8366

EMC Corp.  
 Manchester.....(203)646-8085

FL Intel Corp.  
 Ft. Lauderdale.....(305)771-0600

Maitland.....(305)628-2393

GA Intel Corp.  
 Norcross.....(404)449-0541

IL Intel Corp.  
 Rolling Meadows.....(312)981-7200

IN Intel Corp.  
 Indianapolis.....(317)875-0623

IA Intel Corp.  
 Cedar Rapids.....(319)393-5510

KS Intel Corp.  
 Overland Park.....(913)642-8080

MD Intel Corp.  
 Hanover.....(301)796-7500

MA Intel Corp.  
 Chelmsford.....(617)256-1800

EMC Corp.  
 Newton.....(617)244-4740

MI Intel Corp.  
 Southfield.....(313)353-0920

MN Intel Corp.  
 Edina.....(612)835-6722

## Intel Corporation (Continued)

MO Intel Corp.  
 Earth City.....(314)291-1990

NJ Intel Corp.  
 Edison.....(201)225-3000

NM BFA Corporation  
 Las Cruces.....(505)523-0601

Albuquerque.....(505)292-1212

NY Intel Corp.  
 Hauppauge.....(516)231-3300

Poughkeepsie.....(914)473-2303

Rochester.....(716)424-1050

T-Squared  
 Syracuse.....(315)463-8592

Victor.....(716)924-9101

NC Intel Corp.  
 Greensboro.....(919)294-1541

OH Intel Corp.  
 Dayton.....(513)890-5350

Cleveland.....(216)464-2736

OK Intel Corp.  
 Tulsa.....(918)744-8068

OR Intel Corp.  
 Beaverton.....(503)641-8086

PA Intel Corp.  
 Fort Washington.....(215)641-1000

Pittsburgh.....(412)823-4970

Q.E.D. Electronics  
 Hatboro.....(215)674-9600

TX Intel Corp.  
 Dallas.....(214)241-8087

Houston.....(713)784-3400

Industrial Digital Systems Corp.  
 Houston.....(713)988-9421

Intel Corp.  
 Austin.....(512)454-3628

UT Intel Corp.  
 Bountiful.....(801)292-2164

Salt Lake City.....(801)533-8086

VA Intel Corp.  
 Richmond.....(804)282-5668

WA Intel Corp.  
 Bellevue.....(206)453-8086

WI Intel Corp.  
 Brookfield.....(414)784-9080



Interactive Images Inc.

21 Olympia Avenue  
Woburn, MA 01801.....(617)938-8440

Interlan, Inc.

3 Lyberty Way  
Westford, MA 01886.....(617)692-3900  
TLX: 95-1909

Interphase Corporation

2929 Merrell  
Dallas, TX 75229.....(214)350-9000

O.E.M. Product Manager: Bobby Walker

Sales Representatives:

AL Pen-Tech Associates, Inc.  
Huntsville.....(205)881-9298

AZ Peripherals, Inc.  
Phoenix.....(602)242-7800

CA Qualtech Associates  
Orange.....(714)639-9820

No. Hollywood.....(213)765-1419

San Diego.....(619)274-8580

Interphase Corporation  
San Jose.....(408)293-8343

FL Pen-Tech Associates  
Casselberry.....(305)645-3444

Deerfield Beach.....(305)421-4989

GA Pen-Tech Associates, Inc.  
Marietta.....(404)424-1931

IL Adtech  
Park Ridge.....(312)692-7320

IA T.R.I.  
Cedar Rapids.....(319)303-1200

KS T.R.I.  
Wichita.....(316)681-0242

MD Spectro Associates  
Rockville.....(301)279-2010

MA R. D. Stout  
Acton.....(617)263-1128

MO T.R.I.  
Earth City.....(314)291-0001

Kansas City.....(816)756-3575

NB T.R.I.  
Lincoln.....(402)475-2115

NM Peripherals  
Albuquerque.....(505)848-9170

NC Pen-Tech Associates, Inc.  
Greensboro.....(919)852-6000

Interphase Corporation (Continued)

OH Applied Data Management  
Cincinnati.....(513)579-8108

OR E.T.S.  
Hillsboro.....(503)640-8086

PA Technico  
Trevose.....(215)245-8411

TX Digital Solutions  
Dallas.....(214)980-1984

Austin.....(512)451-0755

Houston.....(713)988-9733

WA E.T.S.  
Kirkland.....(206)827-8086

Intersil Systems, Inc.

1275 Hammerwood Ave.  
Sunnyvale, CA 94086.....(408)743-4442

Inventive Systems, Inc.

P.O. Box 220  
Lexington Park, MD 20653.....(301)863-5153

Konan Corporation

1448 N. 27th Ave.  
Phoenix, AZ 85009.....(602)269-2649

Sales Contact: Pamela Cannon  
Dan Vasquez

LeCroy Research Systems Corporation

700 South Main Street  
Spring Valley, NY 10977.....(914)425-2000

Lee Data Corporation

10206 Crosstown Cir.  
Minneapolis, MN 55344.....(612)932-0300

Linear Systems, Ltd.

1122 Sanford St.  
Winnipeg, Manitoba  
Canada R3E 2Z9.....(204)774-7991

CA Industrial Modules, Inc.

Santa Clara.....(408)988-1911

Logical MicroComputer Company

140 South Dearborn Street  
Chicago, IL 60603.....(312)580-0250  
TLX: Lexecom

Logitech, Inc.  
165 University Avenue  
Palo Alto, CA 94301.....(415)326-3885

Sales Contact: Pierluigi Zappacosta

Marinco, Inc.  
11760 Sorrento Valley Rd., Ste J  
San Diego, CA 92121.....(619)453-5203

Matrox Electronic Systems, Ltd.  
5800 Andover Avenue  
T.M.R. Quebec  
Canada H4T 1H4.....(514)735-1182  
TELEX: 05-825651

AL Pen-Tech Associates  
Huntsville.....(205)881-9298

AZ P.A.R. Associates  
Phoenix.....(602)243-4267

CA Industrial Modules Inc.  
Santa Clara.....(408)988-1911

CO P.A.R. Associates  
Denver.....(303)371-4140

FL Pen-Tech Associates  
Casselberry.....(305)645-3444  
Deerfield Beach.....(305)421-4989

GA Pen-Tech Associates  
Marietta.....(404)424-1931

IA Technical Representatives Inc.  
Cedar Rapids.....(319)364-8650

KS Technical Representatives Inc.  
Wichita.....(316)681-0242

MD Burgin-Kreh Associates  
Baltimore.....(301)265-8500

MA Nova Sales Inc.  
Lexington.....(617)861-1820

MN Jen-Ray Systems  
Minneapolis.....(612)831-5060

MO Technical Representatives Inc.  
Earth City.....(314)291-0001  
Kansas City.....(816)756-3575

NE Technical Representatives Inc.  
Lincoln.....(402)475-2115

NJ ABC Electronic Sales Co.  
Franklin.....(201)827-9716

MATROX ELECTRONIC SYSTEMS, LTD. (CONTINUED)

NY ABC Electronic Sales Co.  
Pleasantville.....(914)796-8088  
Williston Park.....(516)747-6610

KLM Garner  
Clark Mills.....(315)853-6126

N. Syracuse.....(315)458-6214  
Pittsford.....(716)381-8350

NC Burgin-Kreh Associates  
Raleigh.....(919)781-1100

Matrox Electronic Systems, Ltd. (Continued)

OR Westerberg & Associates  
Portland.....(503)297-1719

PA Knowles Associates  
Huntingdon Valley.....(215)947-5641

TX Mycrosystems Marketing  
Austin.....(512)452-2842

Richardson.....(214)669-2380

Stafford.....(713)491-6550

UT P.A.R. Associates  
Centerville.....(801)292-8145

VA Burgin-Kreh Associates  
Lynchburg.....(804)239-2626

WA Westerberg & Associates  
Bellevue.....(206)453-8881

INTERNATIONAL

Australia  
Measuring & Control Equipment Co.  
Australia.....68-4060  
TLX: 22922 POSSY

Austria  
Bacher Elektronische Gerate GES MBH  
Austria.....(0220)835646-0  
TLX: 131532 BASAT

Denmark  
Jorgen Anderson Ingeniorfirma A.S.  
Denmark.....(02)91-88-88  
TLX: 35378 JORGEX

England  
Perdix Components  
London.....01-690-1914/5  
TLX: 897883 PERDIX

Finland  
OY Fintronic AB  
Helsinki.....  
TLX: 124224 FTRON

France  
Metrologie  
France.....791-44-44  
TLX: 611448 METROLO

Greece  
American Technical Enterprises S.A.  
Athens.....8219-470-8811-271  
TLX: 216046 ATE

Holland  
Matrox Benelux  
Holland.....3456741  
TLX: 76159 MATRX

Israel  
E.I.M. International Electronics Ltd.  
Israel.....(03)744-041

Matrox Electronic Systems, Ltd. (Continued)

Israel  
E.I.M. International Electronics Ltd.  
Israel.....(03)744-041  
TLX: 342362 EIM

Italy  
3G Electronics S.R.L.  
Milano.....5466367/543096  
TLX: 321024 TREGMI

Japan  
Internix Incorporated  
Tokyo.....(03)369-1101  
TLX: 26733 INTERNX

New Zealand  
G.T.S. Engineering Ltd.  
Auckland  
TLX: NZ 60430

Norway  
Nordisk Electronik (Norge) A/S  
TLX: 17546 NENAS

Portugal  
Ditram Componentes e Electronica Lta  
TLX: 14182 BRICKS

Spain  
Unitronics S.A.  
Madrid.....242-52-04  
TLX: 46786 UTRON

Sweeden  
Micro Scandia Industriautomation AB  
TLX: 32685 MICRO

Switzerland  
Relais-Rohr  
Zurich.....(01)301-09-70  
TLX: 58587 ROHR CH

Taiwan  
Multitech International Corp.  
Taipei.....(02)7681232  
TLX: 23756

West Germany  
Ernst Rauscher Systemberatung  
Munchen.....089-878061  
TLX: 5212504 RASY

MBI, Incorporated  
31 Williams Street  
Newton Upper Falls, MA 02164.....(617)964-1399

Marketing Manager: Reed M. Smith

MDB Systems, Inc.  
1995 N. Batavia Street  
Orange, CA 92665.....(714)998-6900

Measurement Systems & Controls Incorporated  
1601 W. Orangewood Ave.  
Orance, CA 92668.....(714)633-2240

Medinova Corporation  
306 Campus Dr.  
Arlington Heights, IL 60004.....(312)870-0855  
Sales Contact: Tom Burdick

Sales Representatives:  
IL ICM Industrial Sales Div.  
Palatine.....(312)253-1975

Megalogic Corporation  
9659 National Road  
Brookville, OH 45309.....(513)833-5222

Mesa Technology Corporation  
16021 Industrial Dr.  
Gaithersburg, MD 20877.....(800)638-2039  
TWX: 710-828-9702

Sales Representatives:  
CA Beckrep  
La Crescento.....(213)957-1111

Metacomp, Inc.  
9466 Black Mountain Road  
San Diego, CA 92126.....(619)578-9840

Sales Contact: Gary Pyles  
Brooks Morck

Sales Representatives:  
AR MarTech Assoc.....(602)994-1285  
CA MAC-i  
Fountain Valley.....(714)839-3341  
Milpitas.....(408)946-8885  
Woodland Hills.....(213)347-5900  
Mesa Engineering  
San Diego.....(619)278-8021  
CO Radco Electronics  
Littleton.....(303)794-4279  
MD SIMCOMP  
Gaithersburg.....(301)258-9358

## Metacomp, Inc. (Continued)

MN Micro Resources, Inc.  
Edina.....(612)830-1454  
MA J. Redding Associates  
Acton.....(617)263-8206  
NY J. Redding Associates  
North Port.....(516)754-2130  
ND Micro Resources, Inc.  
Edina, MN.....(612)830-1454  
OR Electronics Technical Sales  
Beaverton.....(503)641-5180  
PA Monument Technical Associates  
Jenkintown.....(215)884-3737  
SD Micro Resources  
Edina, MN.....(612)830-1454  
TX Microsystems Marketing  
Austin.....(512)452-2842  
Dallas.....(214)669-2380  
Houston.....(713)491-6550  
WA Electronics Technical Sales  
Kirkland.....(206)827-8086

## INTERNATIONAL

France  
Tekelec Airtronics  
Paris.....(1)534.75.35  
W. Germany  
Allmos Electronic GmbH  
Martinsreid.....(089)8572086-89  
United Kingdom  
Micro-Marketing Ltd.  
Bucks.....(06285)29222

Methode Electronics, Inc.

7444 W. Wilson Avenue  
Chicago, IL 60656.....(312)867-9600  
TWX: 910221-2468

Microbar Systems, Inc.

1120 San Antonio Road  
Palo Alto, CA 94303.....(415)964-2862

President: Rich Boberg

Sales Representatives:

AZ Peripherals Inc.  
Phoenix.....(602)242-7800

AL Pen-Tech Associates, Inc.  
Huntsville.....(205)881-9289

CA Qualtech Associates  
Palo Alto.....(415)494-9060  
Los Angeles.....(213)765-1419  
Orange.....(714)639-9820

FL Pen-Tech Associates  
Deerfield Beach.....(305)421-4989  
Maitland.....(305)645-3444

GA Pen-Tech Associates, Inc.  
Marietta.....(404)424-1931

MD Robert Electronic Sales  
Catonsville.....(301)788-2380

MA J. Redding Associates  
Acton.....(617)263-8206

MN Micro Resources, Inc.  
Minneapolis.....(612)830-1454

NM Peripherals Inc.  
Albuquerque.....(602)242-7800

NY J. Redding Associates  
Rochester.....(716)442-8520

NC Pen-Tech Associates, Inc.  
High Point.....(919)852-6000

OH Applied Data Management, Inc.  
Cincinnati.....(513)579-8108

OR Westerberg & Associates  
Boring.....(503)292-1719

PA Monument Technical Associates, Inc.  
Jenkintown.....(215)884-3737

Microbar Systems, Inc. (Continued)

TX Mycrosystems Marketing  
Austin.....(512)452-2842  
Dallas.....(214)238-7157  
Richardson.....(214)669-2380  
Stafford.....(713)491-6550

WA Westerberg & Associates  
Bellevue.....(206)453-8881

CANADA

Transduction.....(416)625-1907

INTERNATIONAL

England

ISG Data Sales Ltd.  
England.....(7535)57955

Microcomputer Systems Corporation

432 Lakeside Drive  
Sunnyvale, CA 94086.....(408)733-4200

MicroDesigns, Inc.

1874 Forge St.  
Tucker, GA 30084

Sales Contact: Dave Cornish

Micro Digital Associates

12791 Western Ave., #C  
Garden Grove, CA 92641.....(714)891-2363

Sales Representatives:

AZ Peripherals, Inc.  
Phoenix.....(602)242-7800

CA Micro Digital, Inc.  
Garden Grove.....(714)891-2363  
Datarep  
San Jose.....(408)279-1212

CO Eissler Sales & Service  
Littleton.....(303)794-1779

FL Reynolds & Associates  
Melbourne.....(305)259-7000

OH Dolfuss-Root & Co.  
Strongsville.....(216)238-0300



Micrographics Research  
28 Pioneer Drive  
Nashua, NH 03062.....(603)888-6790

Micro Industries  
691 Greencrest Dr.  
Westerville, OH 43081.....(614)895-0404

Micromation Incorporated  
1620 Montgomery Street  
San Francisco, CA 94111.....(415)398-0289

Micro Memory, Inc.  
9434 Irondale Ave.  
Chatsworth, CA 91311.....(213)998-0070

Micro/Sys, Inc.  
1367 Foothill Blvd.  
La Canada, CA 91011.....(213)790-7267

Sales Contact: Ken Finster

Microvoice Systems Corporation  
23362 Peralta Dr., Ste 5  
Laguna Hills, CA 92653.....(714)859-1091

Midwest Micro-Tek, Inc.  
5930 Brooklyn Blvd.  
Brooklyn Center, MN 55429.....(612)560-6530

Mini Computer Technology  
696 East Trimble Road  
San Jose, CA 95131.....(408)942-1616  
TWX: 910-338-2281

Mitac Inc.  
2906 Scott Blvd.  
Santa Clara, CA 95050.....(408)988-0258  
TLX: (0254) 910-338-2201 MAIOSNTA

Sales Contact: Francis Chien

Mobius Engineering  
4869 Topanga Canyon Blvd., Ste 7  
Woodland Hills, CA 91364.....(213)716-6698

Modular Integration Incorporated  
Bldg. C., Ste #1  
1145 - 12th Ave. NW, P.O. Box 1079,  
Issaquah, WA 98027.....(206)392-8085

Monolithic Systems Corp.  
84 Inverness Circle East  
Englewood, CO 80112.....(303)770-7400

Sales Contact: Joel Berkman

Sales Representatives:

AL Southeast 1st Rep  
Birmingham.....(205)967-7082

AZ Faser Technical Sales  
Scottsdale.....(602)948-4404

CA Western Scientific Marketing  
Fullerton.....(213)628-8023  
San Diego.....(619)565-6699

Santa Barbara.....(805)966-0088

I/O Sales  
Mountain View.....(415)968-1080

Regional Sales Office  
Signal Hill.....(213)498-7946

CO Electrodyne Inc.  
Aurora.....(303)695-8903

FL Southeast 1st Rep  
Melbourne.....(305)784-4723

GA Southeast 1st Rep  
Atlanta.....(404)393-2073

IL Sumer Inc.  
Rolling Meadows.....(312)991-8500

Regional Sales Office  
Schaumburg.....(312)843-3405

Monolithic Systems Corp. (Continued)

IN Miltronics Digital Hardware  
Columbus.....(812)376-6321

KS Design Solutions Inc.  
Wichita.....(316)529-0114

KY WC Koepf Inc.  
Louisville.....(502)231-0531

MA Vector Sales  
Allston.....(617)787-2970

MD J4 Systems  
Rockville.....(301)424-0700

MI WC Koepf Inc.  
Milford.....(313)459-9150

MN JR Associates  
Minneapolis.....(612)559-5673

MO Design Solutions Inc.  
Ballwin.....(314)227-7170

NJ Regional Sales Office  
Princeton.....(609)921-2240

NY Ascor Electronics  
New Rochelle.....(914)235-8838

AFJ Engrng  
Rochester.....(716)458-8100

OH WC Koepf Inc.  
Chagrin Falls.....(216)247-5129

Columbus.....(614)457-8248

Dayton.....(513)885-2705

N. Olmsted.....(216)247-5129

OR ES Chase  
Beaverton.....(503)641-4111

UT Electrodyne Inc.  
Salt Lake City.....(801)486-3801

WA ES Chase  
Bellevue.....(206)453-0765

WI Sumer Inc.  
Brookfield.....(414)784-6641

Monolithic Systems Corp. (Continued)

INTERNATIONAL

Australia

R & D Electronics  
Burwood, Victoria.....61-32888-232

France

ASAP  
T. Quentin.....33-30438-233

Greece

Elecomp Ltd.  
Athens.....301-9514-944

Italy

Micro General  
Torino.....39-11594-612

New Zealand

David Reid Data Products  
Auckland.....64-94991-97

So. Africa

EBE Ltd.  
Pretoria.....27-01246-9221

Sweden

Tel Inter  
Farsta l.....46-84904-90

Switzerland

European Sales Office  
Beggingen.....

The Netherlands

Rodelco Electronics  
Rijswijk.....31-70995-750

United Kingdom

Arrow Computer  
Epsom Surrey.....44-03727-42557

West Germany

Semico Computer  
Erbenheim.....49-61217-00028

Morrow Computer & Electronic Design, Inc.  
1140 Murfreesboro Road  
Nashville, TN 37217.....(615)366-1979

Sales Contact: Gary Sullivan

Motorola Semiconductor Products, Inc.  
A Subsidiary of Motorola Inc.  
3501 Ed Bluestein Blvd.  
Austin, TX 78721.....

Mupac Corporation  
10 Mupac Drive  
Brockton, MA 02401.....(617)588-6110

Sales Representatives:

AL Currie, Peak & Frazer  
Huntsville.....(205)536-1506

AZ Trembly Associates  
Tempe.....(602)967-2058

CA DC Electronics  
Santa Clara.....(408)980-1199

Cerco  
San Diego.....(619)560-9143

Mupac Corp.  
Tustin.....(714)271-1121

CO Trembly Associates  
Lakewood.....(303)233-9544

FL Currie, Peak & Frazer  
Orlando.....(305)855-0843

GA Currie, Peak & Frazier  
Duluth.....(404)476-3107

IL Engineered Sales Company  
Addison.....(312)832-8425

IN Hoyle Associates  
Ft. Wayne.....(219)485-6433

Mupac Corporation (Continued)

MD Rep-Tron, Inc.  
Baltimore.....(301)799-7490

MI Micro Sales Corporation  
Northville.....(313)459-1670

MN Loren Green Associates  
Minneapolis.....(612)571-6738

MO Chesco  
St. Charles.....(314)946-6677

Blue Springs.....(816)229-1404

NM Grady Moore Associates  
Albuquerque.....(505)262-1416

NY F & F Associates  
Glen Cove.....(516)671-8900

Labtronics, Inc.  
Syracuse.....(315)455-7314

NV Trembly Associates  
Las Vegas.....(702)369-8700

NC Currie, Peak & Frazier  
Greensboro.....(919)373-0380

OH Micro Sales Corporation  
Dayton.....(513)433-8171

No. Olmsted.....(216)734-3080

PA Micro Sales Corporation  
Pittsburgh.....(412)928-8118

RJI  
King of Prussia.....(215)265-5211

SC Currie, Peak & Frazier  
Columbia.....(803)254-1971

TX Lear Associates, Inc.  
Richardson.....(214)231-5388

Spring.....(713)370-7449

UT Trembly Associates  
Salt Lake City.....(801)486-5292

WA Comtec  
Bellevue.....(206)453-1188

National Instruments  
12109 Technology Blvd.  
Austin, TX 78759.....(512)250-9119  
(800)531-5066

National Semiconductor Corporation

2900 Semiconductor Drive  
Santa Clara, CA 95051.....(408) 721-4671

## Sales Representatives:

AL New Interep Associates  
Huntsville.....(205) 533-1730

AZ National Semiconductor  
Scottsdale.....(602) 945-8473

Fred Board Associates  
Scottsdale.....(602) 994-9388

CA National Semiconductor  
Santa Clara.....(408) 274-6397

Sherman Oaks.....(213) 995-8335

Irvine.....(714) 957-1626

San Diego.....(714) 560-8330

Bay Tech Sales  
Santa Clara.....(408) 727-9404

Great American Rep Company  
Sherman Oaks.....(213) 990-4870

Tustin.....(714) 832-8113

S.R. Electronics  
San Diego.....(714) 560-8330

CO National Semiconductor  
Denver.....(303) 752-1894

Monaghan Sales Associates  
Denver.....(303) 695-7770

CT National Semiconductor  
Wilton.....(203) 762-0378

NRG Limited  
Westport.....(203) 226-7527

FL National Semiconductor  
Miami.....(305) 949-3162

QXI  
Altamont Springs.....(305) 331-0341

St. Petersburg.....(813) 821-2281

Tamarac.....(305) 485-6030

GA National Semiconductor  
Atlanta.....(404) 393-2626

Action Component Sales  
Atlanta.....(404) 393-9494

IL National Semiconductor  
Schaumburg.....(312) 397-8777

Delta Technical Sales  
Arlington Heights.....(312) 253-9440

## National Semiconductor Corporation (Continued)

IN National Semiconductor  
Indianapolis.....(317) 842-5006

Advanced Component Sales  
Indianapolis.....(317) 545-6441

Fort Wayne.....(219) 484-0722

IA Stan Clothier Company  
Cedar Rapids.....(319) 395-0245

KY Advanced Component Sales  
Louisville.....(502) 459-9895

MD National Semiconductor  
Columbia.....(301) 995-0820

Trimark  
Glen Burnie.....(301) 768-2800

MA National Semiconductor  
Lexington.....(617) 861-6520

A/D Systems Sales, Inc.  
Lexington.....(617) 861-6371

MI National Semiconductor  
Farmington Hills.....(313) 553-0600

Representatives of Electronic Products  
Southfield.....(313) 559-1080

Grand Rapids.....(616) 942-1320

MN National Semiconductor  
Minneapolis.....(612) 888-3060

Stan Clothier Co.  
Minneapolis.....(612) 944-3436

MO National Semiconductor  
Kansas City.....(816) 931-9600

Cen Tech  
Baytown.....(816) 358-8100

Earth City.....(314) 291-4230

NJ National Semiconductor  
Paramus.....(201) 967-5300

Northeast Components Corporation  
Franklin Lakes.....(201) 891-6520

NM Reptronix, Inc.  
Albuquerque.....(505) 881-8001

NY National Semiconductor  
Syracuse.....(315) 463-8047

Electra Sales Corp.  
Syracuse.....(315) 463-1248

Rochester.....(716) 424-6280

National Semiconductor Corporation (Continued)

NY National Semiconductor  
Poughkeepsie.....(914)462-2380  
  
Regional Office.....(516)222-1543  
  
Parallax Sales  
Melville.....(516)694-9090  
  
NC Engineering Devices Corporation  
Cary.....(919)469-9323  
  
OH National Semiconductor  
Highland Heights.....(216)461-0191  
  
Micro-Tec, Inc.  
Highland Heights.....(216)442-1555  
  
Columbus.....(614)888-9761  
  
Miamisburg.....(513)866-0380  
  
OR Micro Sales, Inc.  
Portland.....(503)297-4749  
  
PA National Semiconductor  
Ft. Washington.....(215)643-4910  
  
Omega Electronic Sales, Inc.  
Huntington Valley.....(215)947-4135  
  
Micro-Tec, Inc.  
Pittsburgh.....(216)442-1555  
  
SC Engineering Devices Corporation  
Columbia.....(803)772-3738  
  
TN Action Component Sales  
Knoxville.....(615)690-1172  
  
TX National Semiconductor  
Dallas.....(214)690-4552  
  
Carter Associates  
Garland.....(214)276-7151  
  
Austin.....(512)451-0201  
  
Houston.....(713)789-1680  
  
UT Monaghan Sales Associates  
Salt Lake City.....(801)942-6297  
  
VA Trimark  
Newport News.....(804)874-2325  
  
WA National Semiconductor  
Bellevue.....(206)454-4600  
  
Micro Sales, Inc.  
Bellevue.....(206)451-0568

NCR Corp.  
Independent Marketing Org.  
Dayton, OH 45479.....(513)445-2380

NEC Electronics U.S.A., Inc.

1 Natick Executive Park  
Natick, MA 01760.....(617)655-8833

Sales Contact: Jack Courtemanche  
Marketing Manager

Sales Representatives:

AL 20th Century Marketing Inc.  
Huntsville.....(205)533-9281  
  
AZ Eltron  
Phoenix.....(602)266-2164  
  
CA Cerco  
San Diego.....(714)560-9143  
  
Quorum Technical Sales  
Santa Clara.....(408)980-0812  
  
Santana Sales  
Los Alamitos.....(714)827-9100  
  
CO D/Z Associates  
Denver.....(303)429-9369  
  
CT HLM Associates, Inc.  
Waterbury.....(203)753-9894  
  
FL Semtronics, Inc.  
Altamonte.....(305)831-8233  
  
Clearwater.....(813)461-4675  
  
GA Montgomery Marketing Inc.  
Norcross.....(404)447-6124  
  
IL TA Carroll & Associates  
Schaumburg.....(312)843-1125  
  
IN M/S Sales & Associates, Inc.  
Fort Wayne.....(219)484-1904  
  
Indianapolis.....(317)257-8915  
  
KS Advanced Technical Sales  
Overland Park.....(913)492-4333  
  
MD Professional Representatives  
Baltimore.....(301)653-3600  
  
MI Miltimore Sales, Inc.  
Novi.....(313)349-0260  
  
Grand Rapids.....(616)942-9721  
  
MN Electronic Innovators, Inc.  
Eden Prairie.....(612)941-0830  
  
MO Advanced Technical Sales  
St. Louis.....(314)227-4448



NEC Electronics U.S.A., Inc. (Continued)

NV Quorum Technical Sales  
Reno.....(702)849-2415

NH Computech, Inc.  
Nashua.....(603)883-9380

NJ BGR Associates  
Marlton.....(609)428-2440

HLM Associates, Inc.  
Parsippany.....(201)263-1535

NM Cleveland Enterprises, Inc.  
Albuquerque.....(505)265-7893

NY D. L. Eiss & Associates, Inc.  
Syracuse.....(315)457-0492

Rochester.....(716)328-3000

Kingston.....(914)338-7588

HLM Associates, Inc.  
Northport.....(516)757-1606

NC Montgomery Marketing, Inc.  
Cary.....(919)467-6319

OH Imtech, Inc.  
Akron.....(216)666-1185

Dayton.....(513)278-6507

OR Tasco  
Portland.....(503)245-8168

TN 20th Century Marketing, Inc.  
Knoxville.....(615)966-3608

TX Technical Marketing, Inc.  
Austin.....(512)835-0064

Carrollton.....(214)387-3601

Houston.....(713)777-9228

UT D/Z Associates  
Salt Lake City.....(801)268-2876

WA Tasco  
Bellevue.....(206)453-1414

CANADA

Kaytronics, Ltd.  
Concord, Ontario .....(416)669-2262

Ville St. Pierre, Quebec.....(514)367-0101

Surrey, B.C. ....(604)581-7611

North Coast Automation, Inc.

12768 Chillicothe Road  
Chesterland, OH 44026.....(216)729-2200

Sales Contact: Edward J. Rapp

Sales Representatives:

GA MicroSpec, Inc.  
Lawrenceville.....(404)979-3444

MA Electro Kinetics  
Wellesley.....(617)235-9415

OH Motion Technologies  
Toledo.....(419)885-2723

PA Technico  
Trevose.....(215)245-8411

CANADA

Motion Control Systems, Inc.  
Weston, Ontario.....(416)743-7930

Northern Precision Laboratories, Inc.

P.O. Box 1016, 11 Madison Rd.  
Fairfield, NJ 07006.....(201)227-4800

TWX: 710-734-4301

Omnibyte Corporation

245 W. Roosevelt Road, Bldg. I-5  
West Chicago, IL 60185.....(312)231-6880

Sales Contact: Randy Cochran

Optima, Scientific Atlanta

2166 Mountain Industrial Blvd.  
Tucker, GA 30084.....(404)939-6340

Opto 22

15461 Springdale St.  
Huntington Beach, CA 92649.....(714)891-5861

TLX: 692386

Ormec Systems Corp.

7 Linden Park  
Rochester, NY 14625.....(716)385-3520

Sales Contact: Michael G. Mino

Pacific Microcomputers, Inc.  
119 Aberdeen Drive  
Cardiff, CA 92007.....(619)436-8649

Sales Contact: Sherrell Harper

Sales Representatives:

CA TELEMAR  
San Jose.....(408)248-9616  
MAC-I  
Fountain Valley.....(714)839-3341

Los Angeles.....(213)347-5900

San Diego.....(619)268-1199

CO RADCO ELECTRONICS  
Littleton.....(303)794-4279

FL SOUTHEASTERN FIRST REP., INC.  
Melbourne.....(305)259-6373  
(800)432-6241

IL MAR-CON ASSOC., INC.  
Skokie.....(312)675-6450

MA EASTMARK  
Needham.....(617)449-0050

MD SIMCOMP, INC.  
Gaithersburg.....(301)258-9358  
Columbia.....(301)992-0240

NJ GEBHARDT MARKETING  
Springfield.....(201)376-4415

OH DOLFUSS-ROOT  
Strongsville.....(216)238-0300

OR TASCO  
Portland.....(503)245-8168

PA LYNBAR GROUP INC.  
Huntington Valley.....(215)947-3554

TX MID-SOUTHWEST DATA SYSTEMS  
Richardson.....(214)669-0382

WA TASCO  
Bellevue.....(206)453-1414

Pacific Microcomputers, Inc. (Continued)

INTERNATIONAL

Diamond Point International  
Cleveland, OH.....(216)238-0200  
TLX: 433-2049

United Kingdom  
Bleasdale Computer Systems  
London, England.....1-828-6661  
TLX: 28905

Panlmatic Company  
79 Bond St.  
Elk Grove Village, IL 60007.....(312)439-4030  
Sales Contact: Bob Froehlich

Phoenix Computer Graphics  
119 Board Road  
P.O. Box 51914  
Lafayette, LA 70503.....(318)234-0063

Sales Contact: Mike Mulligan

Plessey Microsystems  
451 Hungerford Drive  
Rockville, MD 20850.....(301)279-2892  
(800)368-2738

Procise Corporation  
P.O. Box 1011  
Issaquah, WA 98027.....(206)392-0270

Sales Contact: Ron Brooks

Sales Representatives:

FL Delmac Sales, Inc.  
Orlando.....(305)898-4688

Tamarac.....(305)726-1330

Clearwater.....(305)447-5192

MI Action Component Sales, Inc.  
Novi.....(313)349-3940

MN Micro Resources Inc.  
Minneapolis.....(612)830-1454

PROTEON ASSOCIATES, INC.

Proteon Associates, Inc.  
24 Crescent St.  
Waltham, MA 02154.....(617)894-1980

President: Howard Salwen

Sales Representatives:

CO Colorado Computer Cable Co.  
Boulder.....(303)447-9713

IL Physics Equipment  
Downers Grove.....(312)960-4054

TX Data Systems  
Richardson.....(214)669-0382

VA Gans & Pugh Associates, Inc.  
Arlington.....(703)257-3262

PPM, Inc.  
23945 Mercantile Road  
Cleveland, OH 44122.....(216)292-6006

Prototek, Inc.  
5705 Springdale Rd.  
Cincinnati, OH 45239.....(513)874-5094

Sales Representatives:

CA Datarep, Inc.  
San Jose.....(408)296-1492

CT United Sales, Inc.  
Tewksbury.....(617)658-4281

MA United Sales, Inc.  
Tewksbury.....(617)658-4281

MD Simcomp  
Gaithersburg.....(301)258-9358

NH United Sales, Inc.  
Tewksbury.....(617)658-4281

NV Datarep, Inc.  
San Jose, CA.....(408)296-1492

TX Matthews Assoc.  
Carrollton.....(214)242-8116

VA Simcomp  
Gaithersburg.....(301)258-9358

WA Simcomp  
DC Gaithersburg.....(301)258-9358

Questar Computer Systems, Inc.  
560 Parrott St.  
San Jose, CA 95112.....(408)286-2866

Raster Graphics

P.O. Box 23334  
Tigard, OR 97223.....(503)620-2241

Sales Contact: Phillip Smith

Sales Representatives:

IA The Beams Co.  
Des Moines.....(515)255-1148

KS The Beams Co.  
Shawnee Mission.....(913)631-0300

MO The Beams Co.  
St. Louis.....(314)569-1060

PA Monument Technical Associates  
Jenkintown.....(215)884-3737

INTERNATIONAL

Austria

Microtek Computersystems....(02242) 8381

Relms

1650 Ste. B, Berryessa Rd.  
San Jose, CA 95133.....(408)732-5520

R & D Electronics (Pty) Ltd.

P.O. Box 61903  
Marshalltown  
2107 South Africa.....(011)834-1204/5  
TLX: 8-3046 SA

Sales/Marketing: T G Enterprises  
Al Feinstein, Dir. Mktg.

Sales Representatives:

INTERNATIONAL

South Africa

T G Enterprises  
Johannesburg.....(11)834-7212  
TLX: 8-3046

France

Metrologie  
Paris.....(1)790-6240  
TLX: 611448

Robotrol Corp.  
1250 Oakmead Parkway, Ste 210  
Sunnyvale, CA 94086.....(408)732-8813

Sales Representatives:

AL Pen-Tech Associates, Inc.  
Huntsville.....(205)881-9298

CA Knott Engineering  
Santa Ana.....(714)838-9289

FL Pen-Tech Associates, Inc.  
Casselberry.....(305)645-3444

Deerfield Beach.....(305)421-4989

GA Pen-Tech Associates, Inc.  
Marietta.....(404)424-1931

MI Infinity Inc.  
Southfield.....(313)557-7230

NC Pen-Tech Associates, Inc.  
Greensboro.....(919)852-6000

OH Infinity, Inc.  
Bedford Heights.....(216)439-8146

SBE, Inc.  
4700 San Pablo Ave.  
Emeryville, CA 94608.....(415)652-1805  
TWX: 910-366-2116

Sales Representatives:

AZ RLS Instruments  
Phoenix.....(602)892-9329

CA Nimbus  
Walnut Creek.....(415)524-2000

CT Industro Associates  
Stamford.....(516)487-2620

FL Dixie Tech. Mktg.  
Longwood.....(305)339-7111

GA Dixie Tech. Mktg.  
Atlanta.....(404)962-2530

IA Beams Company  
Des Moines.....(515)255-1148

IL Prairie Associates  
Chicago.....(215)245-8411

SBE, Inc. (Continued)

IN Andrew C. Corrao  
Fort Wayne.....(219)483-0579

KS Beams Company  
Kansas City.....(913)631-0300

KY Applied Data Mgmt.  
Lexington.....(513)579-8108

MA Daner-Hayes  
Waltham.....(617)894-7290

MD Spectro Associates  
Rockville.....(301)279-2010

MI FAVCO  
Birmingham.....(313)644-0173

Grand Rapids.....(616)459-4425

MN Integrated Peripheral Systems  
Edina.....(612)831-0349

MO Beams Company  
St. Louis.....(314)569-1060

NJ Daner-Hayes  
Glen Gardner.....(201)527-4534

NM RLS Instruments  
Albuquerque.....(505)265-4187

NY Daner-Hayes  
Brewster.....(914)279-2168

White River Junction.....(802)295-5260

NC Dixie Tech. Mktg.  
Mt. Airy.....(919)789-9759

OH Applied Data Mgmt.  
Cincinnati.....(513)579-8108

PA Daner-Hayes  
Doylestown.....(215)345-6056

Technico  
Trevose.....(215)245-8411

INTERNATIONAL

England  
LSSA  
London.....44-1-731-4146

Scanbe, Div. of Zero

3445 Fletcher Ave.

El Monte, CA 91731.....(213)579-2300

President: Robert Miller

Sales Representatives:

AL Beacon Electronics  
Huntsville.....(205)881-5031

AZ O'Donnel Associates  
Phoenix.....(602)274-6072

CA McKinley Electronic Sales  
San Diego.....(714)271-7221

Local Sales, Inc.  
Anaheim.....(714)956-1560  
(213)924-1691

Taarcom, Inc.  
Sunnyvale.....(408)730-9595

CO Component Sales, Inc.  
Denver.....(303)759-1666

FL Beacon Electronics  
Clearwater.....(813)796-2378

Ft. Lauderdale.....(305)491-1054

Ft. Walton Beach.....(813)796-2378

GA Beacon Electronics  
Atlanta.....(404)256-9640

IL D. Dolin Sales  
Chicago.....(312)286-6200

IN Electro Reps  
Indianapolis.....(317)255-4147

MD Beacon/North, Inc.  
Randallstown.....(301)534-7200

MA Stone Component Sales  
Framingham.....(617)875-3266

MI Jack M. Thorpe Co.  
East Detroit.....(313)779-6363

MN Gibb Electronic Sales  
Minnetonka.....(612)935-4600

Scanbe, Div. of Zero (Continued)

NJ MOS Associates  
Randolph.....(516)487-3966

NM Fry-Gates Company  
Albuquerque.....(505)298-1875

NY MOS Associates  
Great Neck.....(516)487-3966

D.L. Eiss Associates, Inc.  
Rochester.....(716)328-3000

Syracuse.....(315)457-0492

Kingston.....(914)338-7588

NC Beacon Electronics  
Greensboro.....(919)275-9997

OH James Finnegan Co.  
Cleveland.....(216)238-5905

OR Olson Ferree & Associates  
Hillsboro.....(503)640-9660

PA Elf Sales, Inc.  
Prospect Park.....(215)534-3340

TN Beacon Electronics  
Johnson City.....(615)282-2421

TX Nova Marketing, Inc.  
Dallas.....(214)385-9669

Houston.....(713)933-2636

UT Component Sales, Inc.  
Salt Lake City.....(801)484-4222

VA Beacon/North, Inc.  
Falls Church.....(703)534-7200

WA Olson, Ferree & Associates  
Bellevue.....(206)883-7792

WI D. Dolin Sales  
Milwaukee.....(414)482-1111



Schneider Instrument Company  
8115 Camargo Road  
Cincinnati, OH 45243.....(513)561-6803

Sales Contact: G. L. Schneider

Scientific Micro Systems, Inc.  
777 E. Middlefield Road  
Mountain View, CA 94043.....(415)964-5700

President: Hugh J. Kern

Sales Contact: Jerry Tennant

Scion  
12310 Pinecrest Road  
Reston, VA 22091.....(703)476-6100

SGS Semiconductor Corp.  
1000 East Bell Road  
Phoenix, AZ 85022.....(602)867-6100

Shugart Associates  
475 Oakmead Parkway  
Sunnyvale, CA 94086.....(408)733-0100  
TWX: 910-339-9355

Sibthorp Systems, Inc.  
800 Cox Avenue  
Erlanger, KY 41018.....(606)525-1300

President: Dr. R. J. Sibthorp

Sales Contact: Jeff Hanna

Sales Representatives:

CA Marketing Services Co.  
Orange.....(714)978-0721

IN Loren Green Associates  
Indianapolis.....(317)293-9827

MI Electro Sales Associates  
Livonia.....(313)474-7320

OH Electro Sales  
Dayton.....(513)426-5551

Cleveland.....(216)261-5440

PA Electro Sales  
Allison Park.....(412)487-3801

Silicon Control  
P.O. Box 1251  
Northbrook, IL 60062.....(312)634-9313

Single Board Solutions  
7669 Rainbow Drive  
Cupertino, CA 95014.....

Sky Computers  
Foot of John St.  
Lowell, MA 01852.....(617)454-6200

Speech Plus, Inc.  
461 N. Bernardo Ave.  
Mountain View, CA 94043.....(415)964-7023

Stynetic Systems  
Flowerfield, Bldg. 1  
St. James, NY 11780.....(516)862-7670

Summagraphics Corporation  
35 Brentwood Ave.  
Fairfield, CT 06430.....(203)384-1344  
TLX: 964348

Sun Microsystems  
2550 Garcia Ave.  
Mountain View, CA 94043.....(415)960-1300

Systech Corporation

7630 Miramar Road  
San Diego, CA 92126.....(619)695-3420  
TLX: ITT 499-0507 SYSTC

Sales Contact:

Sales Representatives:

AZ Peripherals, Inc.  
Phoenix.....(602)424-7800

CA Qualtech Associates  
Palo Alto.....(415)494-9060  
North Hollywood.....(213)765-1419  
Orange.....(714)639-9820  
San Diego.....(619)274-8580

CO Eissler Sales & Services  
Littleton.....(303)794-1779

CT R. D. Stout Associates  
Danbury.....(203)794-1884

KS Panatek Technical Sales, Inc.  
Prairie Village.....(913)362-3349

MD Spectro Associates  
Rockville.....(301)279-2010

MA R. D. Stout Associates  
Acton.....(617)263-1128

OH Swenson & Associates  
Dayton.....(513)435-2772

PA Lynbar Group, Inc.  
Huntington Valley.....(215)947-3554

INTERNATIONAL

Belgium

Consultech International  
Brussels.....  
TLX: 63234 CTEC

Western Pacific/Far East

MB International  
San Diego.....(619)232-8772

Systemathica Consulting Group

4732 Wallingford St.  
Pittsburgh, PA 15213.....(412)621-8362

Systems Group

1601 W. Orangewood Ave.  
Orange, CA 92668.....(714)633-3470

Texas Instruments Incorporated

12201 Southwest Freeway  
Houston, TX.....(713)490-2000  
TLX: 7-3324 CABLE: TEXINS  
TWX: 910-861-4702

The Destek Group, Inc.

830 E. Evelyn St.  
Sunnyvale, CA 94086.....(408)737-7211

Thinline Protocards

Div. of Zappenflash Prods.  
Box 692  
Newberg, OR 07132.....(913)432-4910

Thomas Engineering Co.

1040 Oak Grove Road  
Concord, CA 94518.....(415)680-8640

3Com Corporation

1390 Shorebird Way  
Mountain View, CA 94043.....(415)961-9602

VP Marketing: Larry Hartge

TITN, Inc.

500 Airport Blvd. S., Ste 206  
Burlingame, CA 94010.....(415)348-9181

Toko America, Inc.

5520 West Touhy Ave.  
Skokie, IL.....(312)677-3642

TSD Display Products, Inc.  
35 Orville Drive  
Bohemia, NY 11716.....(516)589-6800

Unitrack Div., Calabro Industries, Inc.  
1372 Enterprise Dr., P.O. Box 1927  
Westchester, PA 19380.....(215)692-0800

U.S. Design Corporation  
5100 Philadelphia Way  
Lanham, MD 20706.....(301)577-2880

TWX: 710-826-0417

Veco Electronics  
171 Bridge Rd.  
Hauppauge, NY 11788.....(516)234-0400

Vector Electronic Company  
12560 Gladstone Avenue  
Sylmar, CA 91342.....(213)365-9661

Sales Contact: F. L. Hill

Sales Representatives:

IL Newark Electronics  
Chicago.....(312)638-4411

PA Powell Electronics  
Philadelphia.....(215)365-1900

TX Allied Electronics  
Fort Worth.....(817)336-5401

Vector Graphics Inc.  
Thousand Oaks, CA.....(805)499-5831

President: Fred Snow

CEO: Lare Harp

Vermont Microsystems, Inc.  
Box 236  
Winooski, VT 05404.....(802)655-2860

Sales Contact: Greg Peters

Winchester Systems Inc.  
14 Laurel Hill  
P.O. Box 545  
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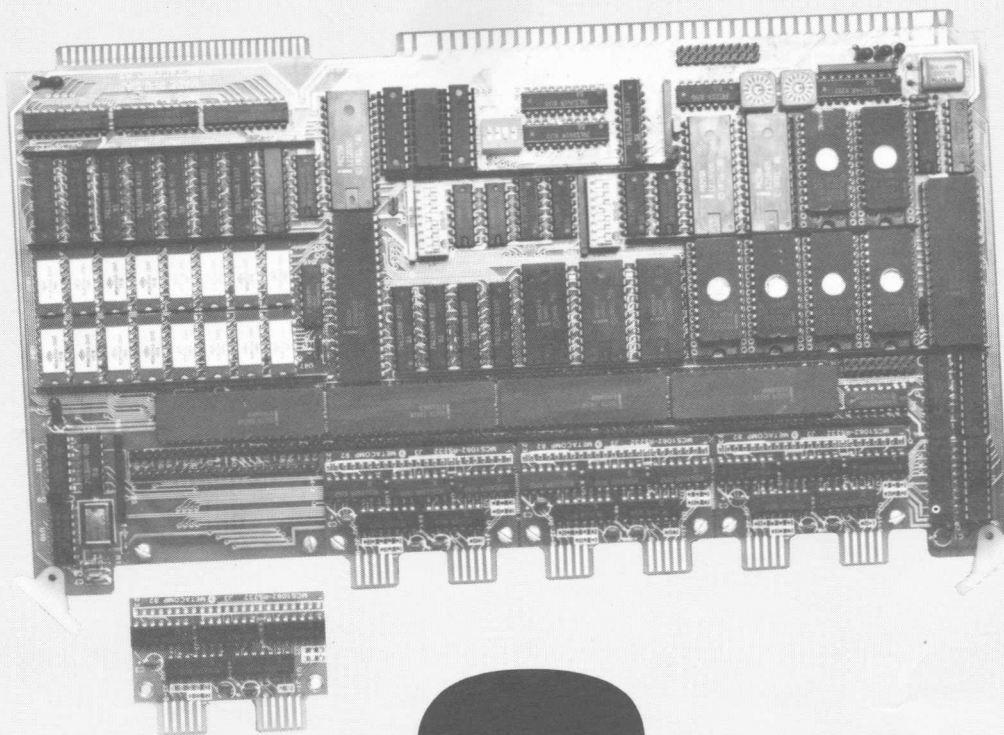
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